june, 1960

nlgi spokesman

journal of the national lubricating grease institute

Grease Mixer Design

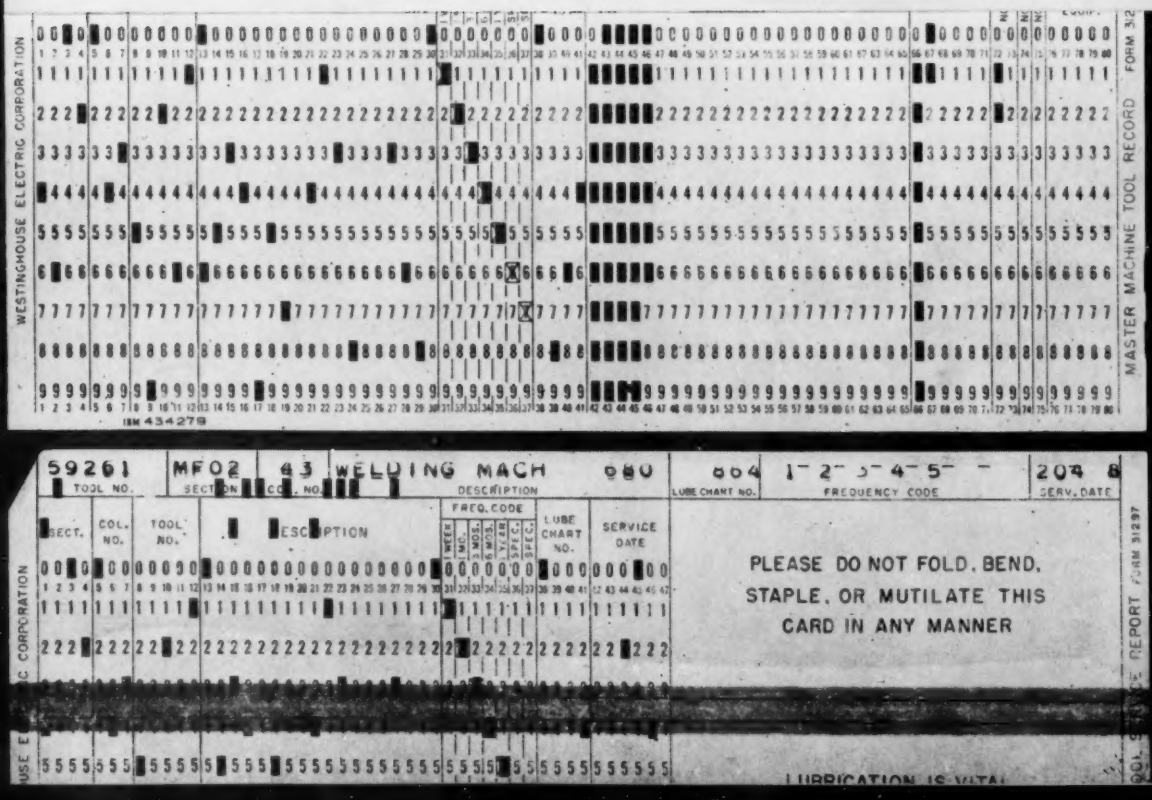
By K. G. TIMM

Westinghouse Grease Dispensing Practice

By R. C. GARRETSON

Transportation Savings

By F. A. VAN ALDEN



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Volume XXIV June, 1960 Number 3

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THE COVER

A PUNCHED card tabulating system is used to schedule the many lubrication jobs required at the East Pittsburgh division of Westinghouse Electric Corp. Each week, master cards are sorted and processed through a reproducer which prepares a detail card, or work order, for each machine which will require servicing during the ensuing week. In his article, "Westinghouse Grease Dispensing Practice," R. C. Garretson describes some of the problems encountered in lubricating the estimated 15,000 pieces of equipment at the division's main plant. See page 95.

The NLGI SPOKESMAN is indexed by Industrial Arts Index and Chemical Abstracts. Microfilm copies are available through University Microfilm, Ann Arbor, Mich.

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News About NLGI

NLGI Representatives

Monsanto Chemical company has named Mr. E. P. Cunningham as Technical representative to NLGI. He is manager of the technical services department of this Associate member firm.

Godfrey L. Cabot, Inc. has appointed Mr. W. M. Parsons as both Company and Technical representative to the Institute. Mr. Parsons, western regional sales manager of the minerals and chemicals division, is headquartered in the company's Chicago office.

1959 Survey Delivered

All four membership classifications have received their copies of the third NLGI production survey, based on pounds of lubricating greases and fluid gear lubricants produced by members in the United States and Canada during 1959.

An historical concept can now be drawn from the findings of 1957, 1958 and 1959 which will be of particular interest to the industry. An analysis will be offered in a later issue of the NLGI SPOKESMAN.

Four more Active members reported their manufacturing in the 1959 survey, making 78.13 per cent complying in the U. S. and giving an estimated 85 per cent of total American production. Six Canadian firms participate.

Friends of NLGI may obtain copies of the data for ten dollars, by contacting the national office.

Technical Committee Column

CHAIRMAN L. C. BRUNSTRUM
Research & Development Dept.
Standard Oil Company (Ind.)

About eighteen months ago it was proposed by E. S. Carmichael that Technical Committee G of ASTM conduct a symposium on the subject of "The Significance of Oil Viscosity in Lubricating Grease." Because this subject is of such great importance to both users and manufacturers of lubricating grease, plans for this symposium have been considered at some length. Messrs. C. L. Pope for ASTM and F. R. Hart for NLGI have agreed that it should be conducted as a joint venture in connection with the 1961 annual NLGI meeting.

Offers to submit papers are being solicited from members of both societies. The papers may cover the significance of oil viscosity in any phase of grease manufacture or use. Some suggested topics are as follows:

- Aeration
- Adhesiveness
- Antirust Properties
- Antiwear Properties
- Control Testing
- Dispensing
- Effect of V.I.
- Low Temperature Properties
- Lubrication at High Speeds
- Manufacture
- Oil Bleeding
- Shear Resistance
- Fretting Corrosion
- Leakage from Bearings
- Slumpability
- Water Wash-Out Resistance
- Rheology

That interest in this symposium will run very high may be judged from the fact that papers have already been offered in the areas of leakage, bearing operation, production, properties, and rheology. Because a program of this kind can be undertaken only at long intervals, it is desirable to make it as comprehensive as possible. You are again urged to submit your offers of papers to either of the following:

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Texaco Inc.
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Standard Oil Company
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Further information concerning details for submitting manuscripts will be developed as soon as the magnitude of the program is known.

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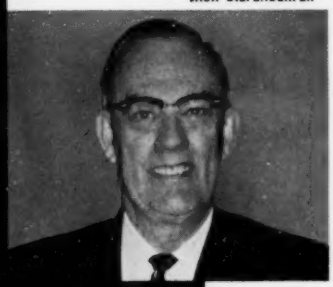

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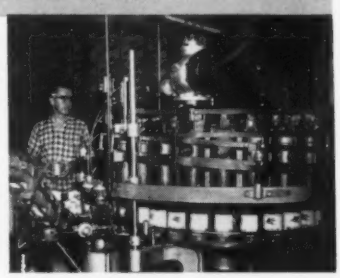

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Future Meetings

JUNE, 1960

5-10 Society of Automotive Engineers, summer meeting, Edgewater Beach Hotel, Chicago

SEPTEMBER, 1960

11-16 American Chemical Society, 138th National Meeting, headquarters undecided, New York.

14 API Division of Marketing, lubrication committee meeting, Hotel Traymore, Atlantic City, New Jersey.

14-16 National Petroleum Association Annual Meeting, Hotel Traymore, Atlantic City, New Jersey.

18-20 IOCA 13th Annual Meeting, Hotel Moraine, Highland Park, Ill.

18-21 ASME Petroleum Mechanical Engineering Conference, Jung Hotel, New Orleans.

OCTOBER, 1960

3-4 ASLE 7th Lubrication Conference, Hotel Morrison, Chicago.

9-13 ASTM, Committee D-2 meeting, Mayflower Hotel, Washington, D. C.

10-12 API Division of Marketing, marketing research committee, Baker Hotel, Dallas.

17-19 ASME – ASLE Lubrication Conference, Statler Hilton Hotel, Boston.

OCT. 30-NOV. 1 NLGI Annual Meeting, Edgewater Beach Hotel, Chicago

NOVEMBER, 1960

2 Packaging Institute, petroleum packaging committee meeting, headquarters undecided, New York.

3-4 SAE National Fuels and Lubricants Meeting, Mayo Hotel, Tulsa, Okla.

14-16 API 40th Annual Meeting, Conrad Hilton, Palmer House and Congress Hotels, Chicago.

27-Dec. 2 ASME Annual Meeting, Statler Hilton Hotel, New York.

JANUARY, 1961

9-13 Society of Automotive Engineers Annual Meeting, Cobo Hall and Convention Arena, Detroit.

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NLGI SPOKESMAN

VOLUME XXIII

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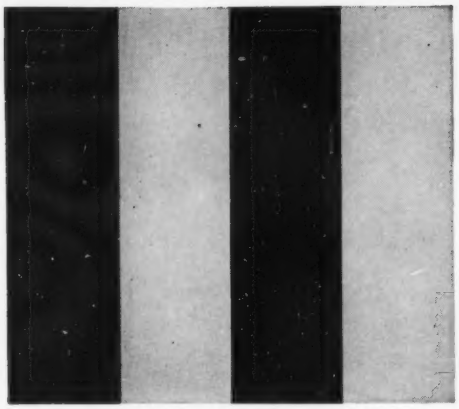
> Automobiles . . . automatic transmission fluids . . . fatty acids . . . manufacture . . . non-soap . . . non-soap thickeners . . . testing . . . gear lubricants . . . marketing . . . non-lubricated bearings . . . and others.

The sturdy green cover holds all twelve issues securely, with an index in the final magazine broken down by author, title and category. A few copies of Volume XXI and XXII are also available. Write NLGI, 4638 J. C. Nichols Parkway, Kansas City 12, Missouri. $7.50 for members, $10.50 for friends of NLGI, plus postage.

Volumes I through XXIII may be purchased from University Microfilms, 313 North First Street, Ann Arbor, Michigan.



NLGI PRESIDENT'S PAGE

By H. A. MAYOR, JR., *President*

An Open Letter

Recognizing that our industry faces unique and perhaps perplexing problems our good technical member, Battelle Memorial Institute, through the efforts of Stanley L. Cosgrove, has developed a thought-provoking Research Program entitled "An Economic Study of Lubricating Grease Market and Technical Planning for Future Industry Growth."

Because of its possible long-range significance to every grease manufacturer, it was thought the entire SPOKESMAN readership would be interested in the following study report covering the proposal.

Mr. Stanley L. Cosgrove
Lubricants Research
Battelle Memorial Institute
505 King Avenue
Columbus 1, Ohio

Dear Mr. Cosgrove:

Time marches on! Although we are still a long ways from a final decision on the proposed NLGI Research Program entitled "An Economic Study of Lubricating Grease Market and Technical Planning for Future Industry Growth," it was discussed preliminarily at our Bedford Springs Directors' Meeting last month.

Because only the members of the Executive Committee were completely familiar with all of your supporting material and correspondence, discussions were necessarily limited. Initial reactions sound favorable, however, and our entire directorship expressed a desire to thoroughly explore the possibilities. To properly and completely inform all of them, the entire proposal file is being spread upon the minutes of the Bedford Board Meeting with the understanding that when the Board assembles again in New York City in September, this material will be at the top of the agenda.

As all of us recognize, good things take time. Your offer of assistance to our industry is much appreciated and it will continue to receive the earnest attention of our Board.

Yours very truly,
H. A. MAYOR, JR.
President

GOING UP BY FLAME!

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CATO OIL AND GREASE COMPANY

Oklahoma City, Oklahoma

Presented at the NLGI 27th annual meeting in New Orleans, October, 1959

Grease Mixer Design

By: K. G. Timm
Struthers Wells Corporation

CONSIDERABLE THOUGHT has been given to the formulation of various types and combinations of lubricants. To combine the ingredients which go to make up any lubricant, some form of blending or mixing action must be applied. Many types of mixing equipment have been suggested as proper methods to bring about a desired result with varying degrees of success. The success or failure of the type of mixer used has been dependent on the efficiency of the unit and the ingenuity of the operator to a great extent. It is the purpose therefore of this paper to acquaint the engineer and the operator with the design characteristics which go into a properly designed mixer for the production of grease.

For many years the processing of grease was more an art than a science. Most grease plants depended on the knowledge and skill of some individual experienced in the art of grease making for the quality control of their product. Throughout the industry there prevailed a conviction among these grease making experts that greases should only be processed in certain types of cast iron vessels, and it was a real pioneering step for the forward-looking grease plant executive to authorize the purchase of welded vessels for grease processing. It was not until the early Thirties that this "bug-a-boo" was broken down and the processing of greases in vessels fabricated from welded plate was used to any extent in this industry.

Along with the diversion of thinking with regard to the processing of a grease, there exists the disagreement with respect to the number of vessels or pieces of equipment necessary for such processing. One school of thought recommends a separate pressure kettle for the formation of soap, which is then blown-over into one or more finishing kettles where oil is added and the grease batch cooled and worked. Another school of thought argues that the proper and more economical method to produce a batch of grease is to use a single kettle in which the soap is made and then the oil added to complete the batch cycle, thus eliminating the need of extra kettles and pumping equipment.

Although both lines of thought have their individual advantages, the writer has chosen the latter type as the one which would be most representative as far as design features are concerned. In addition to discussing the conventional double motion agitator design features of the dual purpose grease kettle, a look into the future will reveal the advantages of the incorporation of a third agitator.

As our multi-action grease kettle, Figure 1, will be used for the manufacture of soap, pressure or vacuum cooking, and the working, cooling and milling of the grease batch, let us examine a pictorial insight into the design of a kettle based on these requirements.

Having first established the method to be used in the production of grease as well as the output demand, the next consideration would be the size and shape of the kettle itself. The size of a grease kettle is based on working capacity expressed in either pounds or gallons plus an overage to allow for foaming, etc., and the space occupied by the agitator elements themselves. The level of the working capacity should be kept at least six inches below the top cross beam of the agitator sweep frame.

Although some authorities would argue that the shape of the grease kettle is not important, repeated installations of hemispherical or parabolic bottom head kettles (shown in Figure 2) are proving to be more advantageous from the standpoint of drainage, heat transfer and built-in ability to assist in the function of agitation so important to the blending of the ingredients as

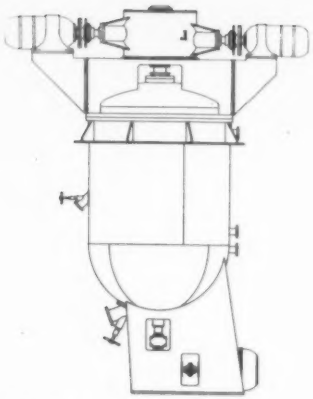

FIGURE 1

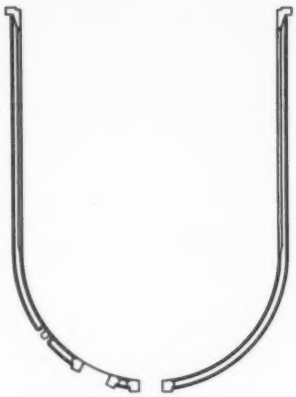

FIGURE 2

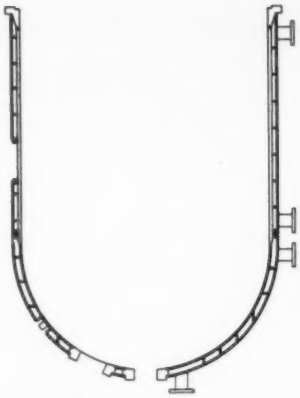

FIGURE 3

well as the working of the grease.

In order to introduce heat into the batch, kettles have been direct fired in the case of high temperature requirement, and jacketed for steam heating for low temperature cooking. Although direct fired kettles are being used throughout the industry, the tendency is to change over to the less hazardous and more convenient high temperature hot oil jacketed kettle. This type of kettle parallels the steam jacketed kettle in design; however, as water cannot be used in the jacket for cooling, as is the case with the steam jacket, other provisions can be made for cooling.

A tried and proved method is to provide the kettle with a split jacket whereby the bottom hemispherical jacketed head is separated from the upper straight side jacketed shell by means of a spacer bar, as shown in Figure 3. The jacket head is piped to the hot oil source providing controlled heat during the heating cycle while the upper jacket is connected to a manifold providing steam to assist during the heating cycle, and cold water to be used during the cooling cycle. The hot oil system if properly designed will have a heat exchanger which can be valved into the piping system to cool the oil during the cooling cycle.

Baffle bars should be provided in the jacket to prevent the heating or cooling fluid from short circuiting across the jacket area resulting in unequal heat transfer through the vessel wall. The spacing of these baffles is important as there is a definite ratio to be maintained to insure adequate liquid velocity.

As we are considering a kettle fabricated from steel or alloy plate material, rather than the cast construction, thereby providing unlimited combinations of shape and size, the thickness of the plate involved is controlled by the ASME Code for Unfired Pressure Vessels based on the working pressure, or vacuum, and the temperature concerned. Here again the use of hot oil as a heating medium in the jacket area becomes an important factor as temperatures of 500° F. can be reached at a maximum design pressure of only 75 P.S.I.G., while to obtain a similar temperature with saturated steam, the plate thickness would have to be increased considerably due to the required design pressure of 680 P.S.I.G. as shown in Figure 4.

The design of the top head is based on the requirements of the mixing process, and if subject to a working pressure exceeding 15 P.S.I.G. will also have to be built in accordance with the ASME Code for Unfired Pressure Vessels. The decision as to whether the top head should be bolted or welded to the shell will depend on two primary factors. The first consideration would be whether or not there is a problem of installation due to building construction and handling facilities. The second consideration would be dependent on the type of agitator sweep construction, whether bolted or welded. In conjunction with the latter, the important consideration of head room for installation of the

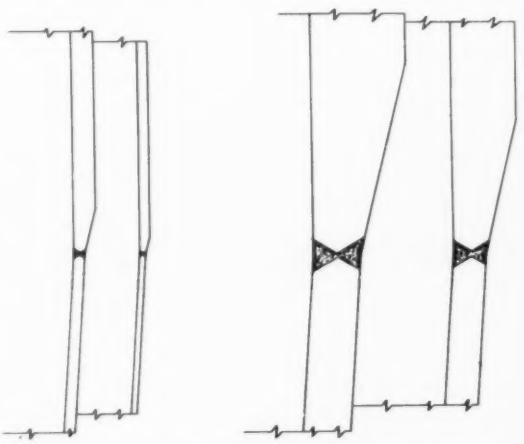

FIGURE 4—Comparable shell and jacket thickness under hot oil (l.) or saturated steam (r.) conditions at 500°F.

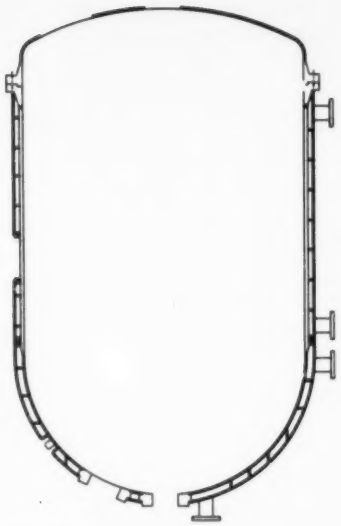

FIGURE 5—Top head cross section.

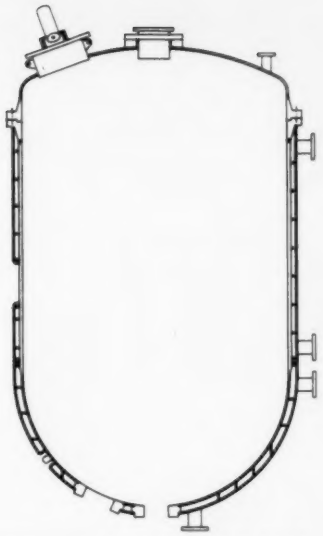

FIGURE 6—Cross section showing top head openings.

welded sweep must not be overlooked. From the standpoint of cost of bolted type versus welded type of top head, it has been found that there is very little difference when one considers the fact that the agitator sweep, in a vessel with a weld type head, must be of a bolted design to pass through the manway for assembly inside the kettle.

In the case of our multi-action grease kettle the top head is bolted into place, as shown in Figure 5, as the agitator sweep frame will be of a welded type to insure maximum strength and ruggedness. (More will be said later regarding the design of the agitator sweep.)

The openings in the top head, Figure 6, of course are sized and located to comply with the specifications of the installation and would be constructed and attached in accordance with the ASME Code requirements. In addition to the stuffing box, which is bolted into place for ease of maintenance, a sight glass with a light glass located approximately 180° from it are recommended to facilitate observation of the batch under pressure or vacuum. Both glasses should be fitted with washing devices. One of the most important openings would be the manway or charging nozzle. As the pressure cover for a 20-inch manway weighs in the neighborhood of

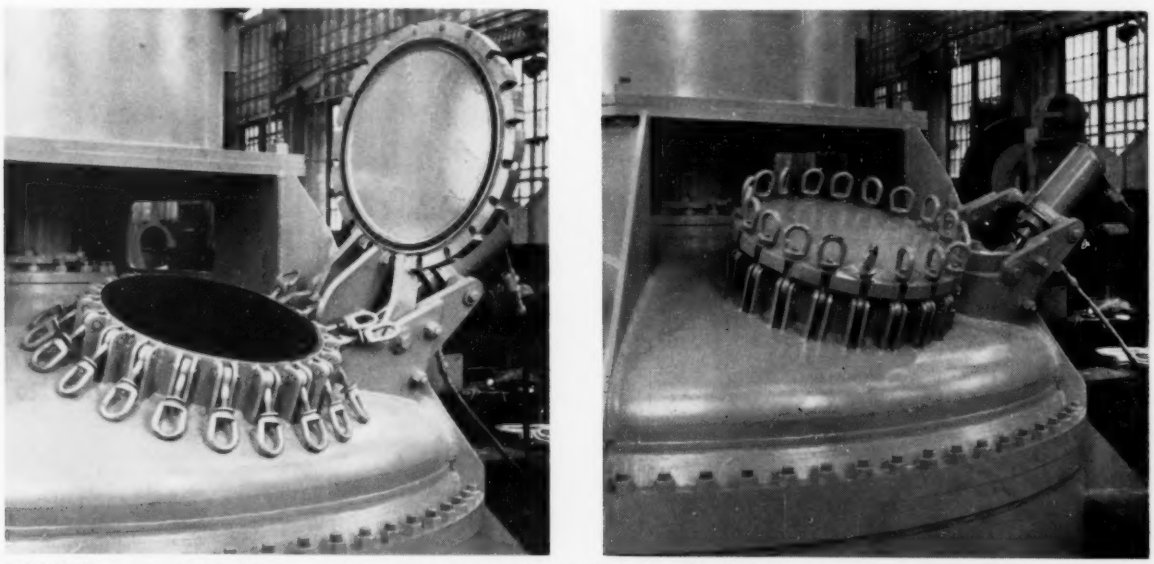

FIGURE 7—A mere flick of the control handle opens or closes the hydraulically-operated manway cover.

300 pounds, a safe and convenient method must be employed to open and close it during the charging and pressurizing cycles.

One of the safest methods employed to date is the convenient hydraulically operated design shown in Figure 7. A mere flick of the control handle opens or closes the heavy cover at will.

Too much consideration cannot be given to the proper design of the grease mixer agitator elements; therefore, we will consider each phase of the multi-action mixer separately.

The primary mixing element is the agitator sweep with the scraper blades attached, Figure 8. A number of different sweep designs have been tried, but, as stated previously, the welded type has proved to be the best design. In designing a sweep having sufficient ruggedness to stand up against the worst possible conditions, a complete description of the grease must be given to the design engineer. In supplying this information it is not necessary to reveal the grease formulation, but only to furnish such data as: penetration, degree of shear desired, soap characteristics, specific heat and gravity, general mixing requirements, and any other data peculiar to the product as it progresses through its various phases to completion. With this complete knowledge of the type of grease to be handled by the mixer, the sweep frame can be designed and made of sufficient strength to withstand racking, bending or twisting during the mixing operation. The triangular design sweep not only gives the maximum strength required, but being streamlined assists in the mixing action by directing the flow of the grease away from the kettle wall. The sweep frame is further braced by cast steel cross arms and a heavy welded top cross beam which tie the vertical legs of the sweep into a compact unit. These cross arms are double pitched to aid in the "top-to-bottom" flow of the grease in the kettle. This flow is down at the shaft and up along the shell wall. The bottom two cross arms are only single pitched to raise the grease and assure its movement out of the bottom head and into the "bottom-to-top" slip stream.

The sweep frame runs on two bearings only, one located at the extreme bottom of the mixer with the main thrust bearing being located in the bottom of the double motion drive head and carrying the agitator sweep by means of a heavy duty hollow quill shaft working through the bolted stuffing box located in the top head.

The sweep frame would not be complete without the attached scraper blades which are so designed and located to scrape approximately 98 per cent of the vessel wall. There are two types of scraper blades: the leading type and the following type, Figure 9. Both have proved satisfactory in operation. It is not necessary to machine the inside of the vessel wall to effect good scraping action, as either type is hinged and free to find its best contacting position around the inner periphery of the vessel. Either type is held in contact with the wall by the loading action of the grease during operation. The scraper blades can be made of various kinds of metal, but whether the material is harder or softer than the vessel wall does not matter as long as the blade approach-angle and hinge action limit control are properly designed.

Located between the sweep frame cross arms and moving counter-rotation to the sweep frame are double pitched paddle arms clamp bolted to a high ten-

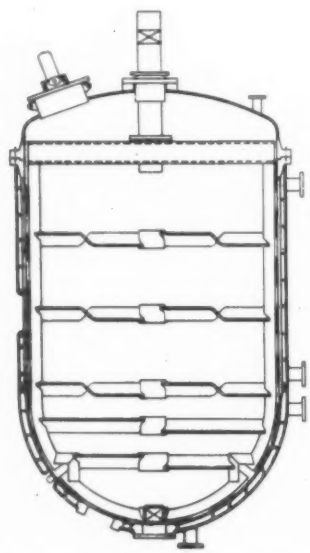

FIGURE 8—This cross section shows the agitator sweep frame and scrapers.

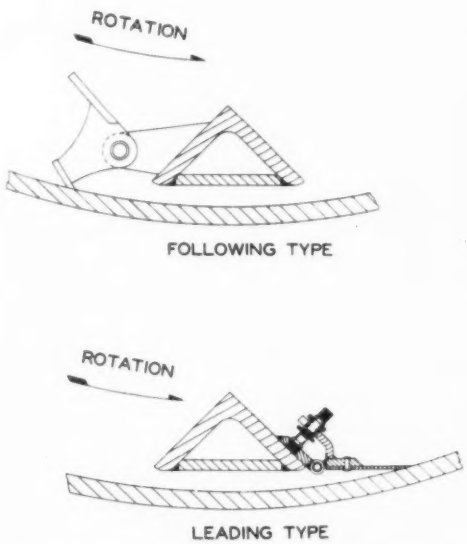

FIGURE 9—Cross section through sweep frame showing the leading and following types of scraper blades.

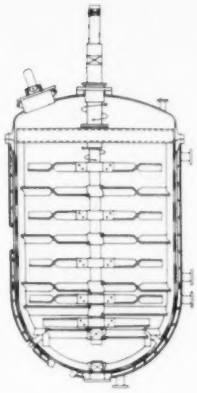

FIGURE 10

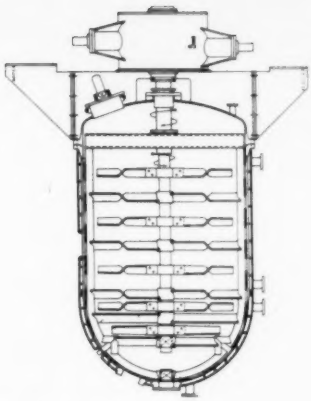

FIGURE 11

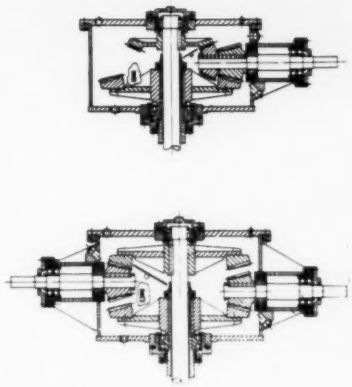

FIGURE 12

sile material inner shaft, Figure 10. The extreme bottom arm is only single pitched forcing the grease down towards the bottom of the kettle to create a more intense action during the manufacture of the soap as well as during the cold working cycle of the grease batch. The paddle arms are of cast steel material and are built with a taper design to add strength. The paddle arms are made in two halves held in position on the shaft by special Gib-head keys driving each half. High tensile bolts hold each assembly together. The removable feature of the paddle arms adds to the versatility of the mixer. The inner shaft is carried in two bearings, one located in the bottom sweep cross arm hub; and the second, or thrust bearing, is located on the top of the double motion drive head.

Attached to the top head is the drive support frame, as shown in Figure 11, which can be of a split bolted design if shipping or installation problems exist. Mounted on the support frame is a double motion drive head, in our case the S.W. Heavy Duty Type No. 26D.

Although the design of the standard drive head indicates a common pinion drive shaft, as shown in the top view of Figure 12, it has been found advantageous both from an input power standpoint and an operational standpoint to employ the flexibility of the drive head design and use separate motor drives for the sweep and inner paddles as is the case with our typical grease mixer, as shown in the bottom view of Figure 12. The design of the double motion drive head with its fully enclosed gear case, hardened bevel gears and oversized anti-friction bearings is built for AGMA Class 2 service. The drive head is provided with a rotary mechanical seal to prevent the loss of pressure or vacuum between the inner paddle shaft and the counter-rotating sweep quill shaft. Proper lubrication of the bevel gears is constantly maintained by an oil bath. The outer bearings are grease packed. The completely closed design of the drive head eliminates any dust and dirt and assures the long wearing life of the unit.

Coupled to the pinion shafts are the horizontal gearmotor drives, Figure 13. To provide the greatest flexibility into the design of the grease mixer, multi-speed motors can be used. The size of these drives are determined by the torque loading on the paddles and sweep frame, and for most applications are designed for constant torque conditions. Only where extreme power requirements are necessary, such as could exist during the manufacture of the "Cooked-In" type of grease, is it necessary to design to constant horsepower conditions. The coupling between the gearmotor and the double motion drive head can serve a dual purpose by not only providing a drive connection, but if equipped with an adjustable friction drive disc, it serves as a protection against gearmotor damage should some foreign object find its way into the mixing vessel and cause a blocking condition between the counter-rotating paddles in the kettle. In keeping with this thought, the multi-action grease mixer is equipped with Falk torque controlled couplings.

Usually only a bottom outlet valve is required; but it has been found that should it be desirable to re-cycle the batch, another valve or valves can be located through the side of the vessel, as shown in Figure 14, thus preventing the spillage of grease on the upper rotating arms causing undue cleaning requirements. The type of valve used should be the flush type valve, thus eliminating any pockets where unmixed ingredients could lodge. Our grease kettle is equipped with the S.W. Flush Type Valves which are simple in design yet effective against high working pressures or vacuum.

The name, multi-action grease mixer, has come into use only recently and is the result of test runs conducted at the Cities Service Oil company laboratory in East Chicago, and the full size installation of this type of equipment at their Cicero, Ill. plant, as well as a similar installation at the Arkansas Fuel Oil corporation, Bossier City, La.

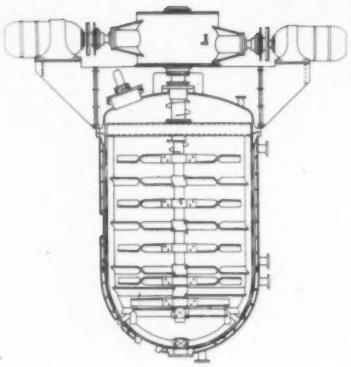

FIGURE 13

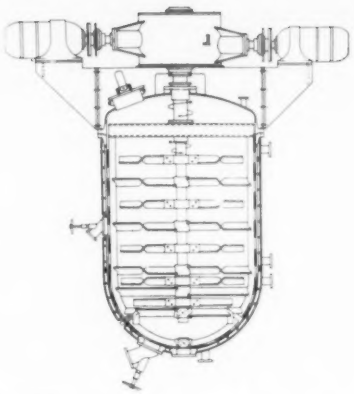

FIGURE 14

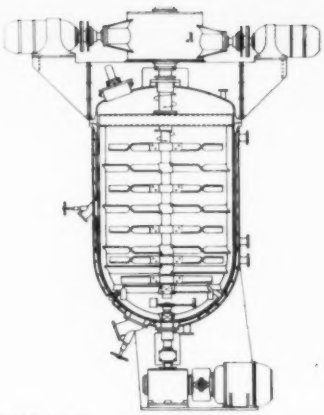

FIGURE 15

The term multi-action implies not only the double motion action of the conventional grease kettle, but adds a third high speed drive through the bottom of the kettle driving a Struthers Wells radial propeller agitator, Figure 15.

To fully appreciate the advantage of this new addition, a brief description of the operation and type of agitation developed by the radial propeller would be in order.

The diagrammatic view shown in the upper right hand corner of Figure 16 shows the principle built into the radial propeller. The vertical blade faces are set at an acute angle from the tangent propelling the liquid radially outward (hence the designation, radial propeller). The angle degree is determined by the required agitation. If severe cutting action is a factor, the degree of angle of the pitch is small. If movement of the contents is required without extreme cutting action, the pitch is increased. This flexibility provides the degree and type of agitation best suited to any specific requirement.

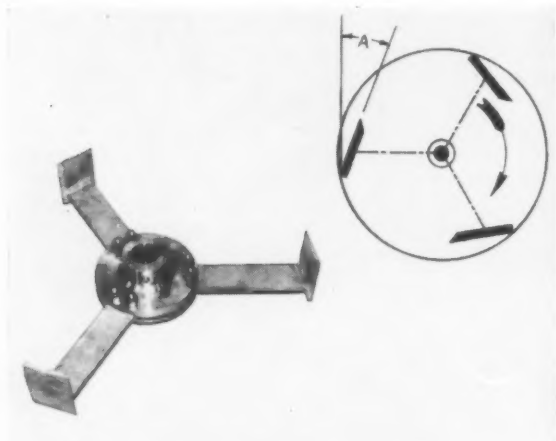

FIGURE 16—The Struthers Wells radial propeller.

The view shown in Figure 17 indicates the flow pattern generated by the radial propeller. The pitch of the vertical blades as noted in the drawing thrusts the liquid outward similar to the action of a turbine, and at the same time creates a suction on the back side of the blade. The liquid, being contained in a vessel, is therefore circulated in the manner shown by the flow lines "A," "B," "C," "D" and "E." The radial propeller runs at high speeds similar to a marine propeller. The resulting high peripheral speed of the vertical blades gives excellent mixing and shearing action to the grease batch.

During the soap formation stage of grease making, the various ingredients are added and the radial propeller blends the mass in a matter of seconds, as shown in Figure 18. During the saponification and dehydration phase, excellent heat transfer is obtained by the combination of the violent action of the radial propeller and the counter-rotating and scraping action of the outer sweep and scrapers. Another major advantage is accomplished during the period of adding oil to the soap to form the grease. The conventional way of introducing oil into the batch is through the top of the mixer where it slowly filters through the semi-plastic mass to convert the entire contents into a finished grease by the action of the double motion agitator only. Visualize, if you will, the oil being introduced through a bottom valve directly into the working area of the radial propeller agitator. Here the oil is instantly blended with the semi-plastic soap; and with the combined action of the sweep frame, scrapers and counter-rotating paddle arms, the soap batch is completely blended in a matter of minutes. As the heat is applied to the kettle bottom, the flow pattern generated by the radial propeller has been found to improve the heat transfer coefficient as much as four times the rate found by using conventional equipment. In a like manner, the cooling cycle of the batch is shortened.

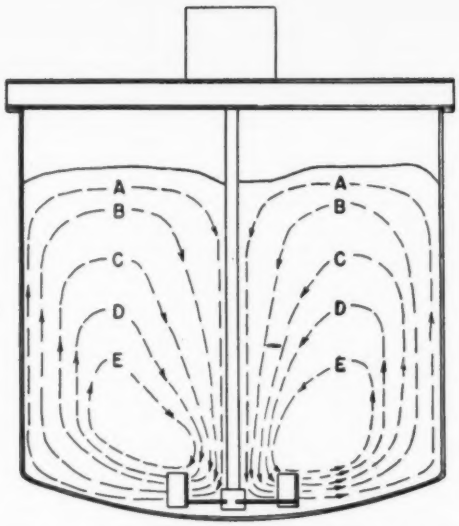

FIGURE 17—This view indicates the flow pattern generated by the radial propeller.

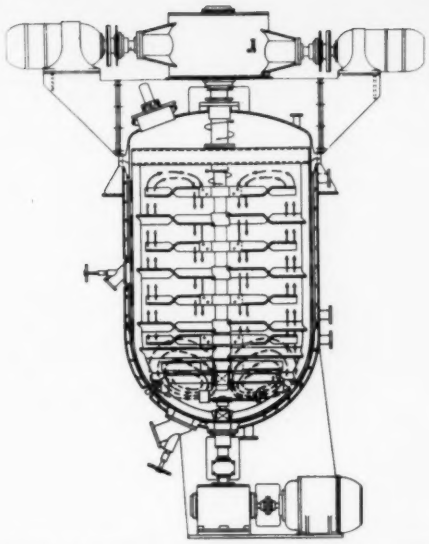

FIGURE 18—A cross section of multi-action grease mixer showing flow patterns generated by mixing elements.

While the sweep and scrapers are constantly removing cooled grease from the vessel wall during the cooling and finishing of the grease batch, the radial propeller is constantly working or milling the batch at a high speeds as it assists in the "top-to-bottom" flow pattern of the grease, as shown in Figure 18. This milling action has eliminated the need for additional milling equipment in most cases.

The bottom entering shaft of the radial propeller drive passes through a double rotary mechanical seal eliminating the maintenance of a conventional packed stuffing box. The drive for the radial propeller is equipped with a multi-speed gearmotor thereby adding to the flexibility of the design.

Of equal importance to the proper design of the moving parts of the mixer and its other appointments is the all-important consideration of an adequate means of supporting the massive assembly in its plant location. In addition to the requirement of supporting the dead load of the equipment, consideration must be given to the live load which exists during the mixing operation. The number of support lugs or brackets is determined by the above consideration as well as the arrangement of the supporting framework into which the equipment will be placed. The continuous ring support with several gusset plates equally spaced around the outer periphery of the vessel gives the best means of distributing the load, although the installation of the vessel into the supporting framework becomes somewhat of a problem.

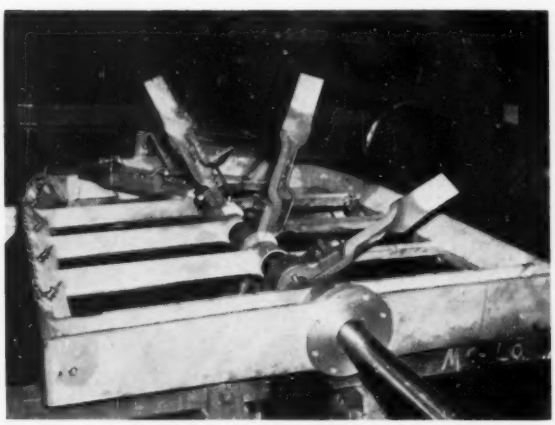

FIGURE 19—A shop view of the paddle shaft thermowell arrangement.

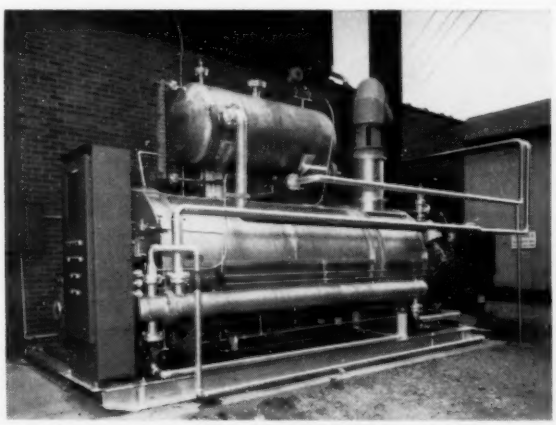

FIGURE 20—Installation of Struthers Wells direct-fired circulating oil heater package unit with oil cooler.

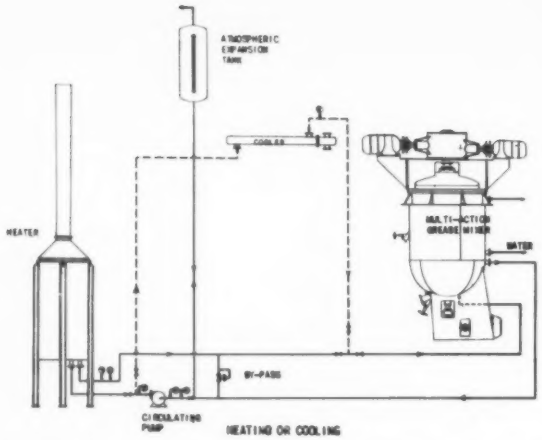

FIGURE 21—Typical circulating oil heating and cooling system in package unit with multi-action grease mixer.

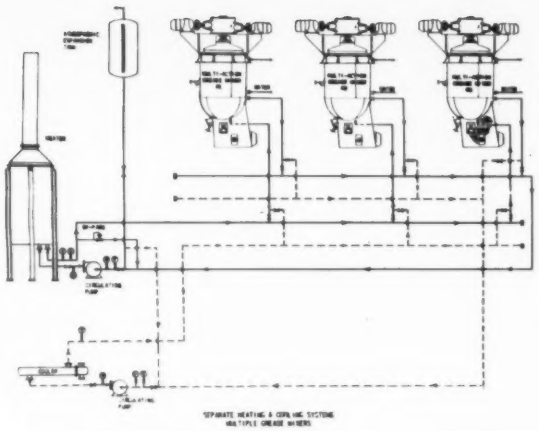

FIGURE 22—Flow diagram showing an arrangement with a battery of kettles.

The location of thermowells in a double motion mixer has always been a problem due to the rotating sweep frame. Flush type thermocouples can be used; however, there is a tendency to pick up some of the adjacent jacketed temperature which results in an incorrect reading. The sweep frame can be offset as is the case with our multi-action grease kettle. This, however, leaves a small unscraped area around the kettle wall.

Some grease kettles have been provided with thermowells located on the paddle shaft, as shown in Figure 19, with the thermocouple wires passing up through the hollow shaft and terminating in silver contactor rings in a housing located on top of the double motion drive head. Although this type of application is slightly more expensive, the batch temperature can be very accurately recorded and controlled.

Having discussed the important design considerations of a typical grease mixer, the complete economic survey of the grease plant would be incomplete if thought were not given to the heating system so important to the process. The proper design of this important phase for the production of grease cannot be over-emphasized. In order to have the grease kettle function at its peak efficiency, several types of companion heating units combined with it into a carefully engineered package are available to the industry. These heating plants are usually designed around the circulating hot oil type of furnace, Figure 20.

The flow diagram shown in Figure 21 indicates the important elements of such a heating and cooling system as supplied as a packaged grease plant by the Struthers Wells corporation. The heating oil used in such systems has a top limit of 600°F. with a low limit of 60°F., thus enabling the unit to service the grease kettle through the entire cycle of grease manufacture as mentioned earlier in this paper. These hot oil furnaces can be direct fired with either gas or oil or may be electrically heated.

They can be sized for one kettle or may serve a battery of kettles, as shown in Figure 22.

In conclusion, the author wishes to point out that although we have reviewed many of the major design considerations of a grease kettle as well as some of the latest developments, there are still other important features which might have been discussed. However, in summary, it can be seen that to properly design a grease kettle for its ultimate efficiency, the need for a complete understanding of the various possibilities of design will result in the realization of that goal. ■

About the Author

K. G. Timm *is manager of the mixing equipment department and supervising engineer in charge of the general equipment division of Struthers Wells Corp. He completed Pennsylvania State college extension courses in engineering, business English and petroleum refining. Mr. Timm joined Struthers Wells in* 1934 *as a design engineer, remaining in that capacity until* 1946, *when he was promoted to the position of manager of the mixing equipment department. During the past year, he was given additional responsibility as supervising engineer in charge of the general equipment division.*

Westinghouse Grease Dispensing Practice

By:

R. C. Garretson

Westinghouse Electric Corp.

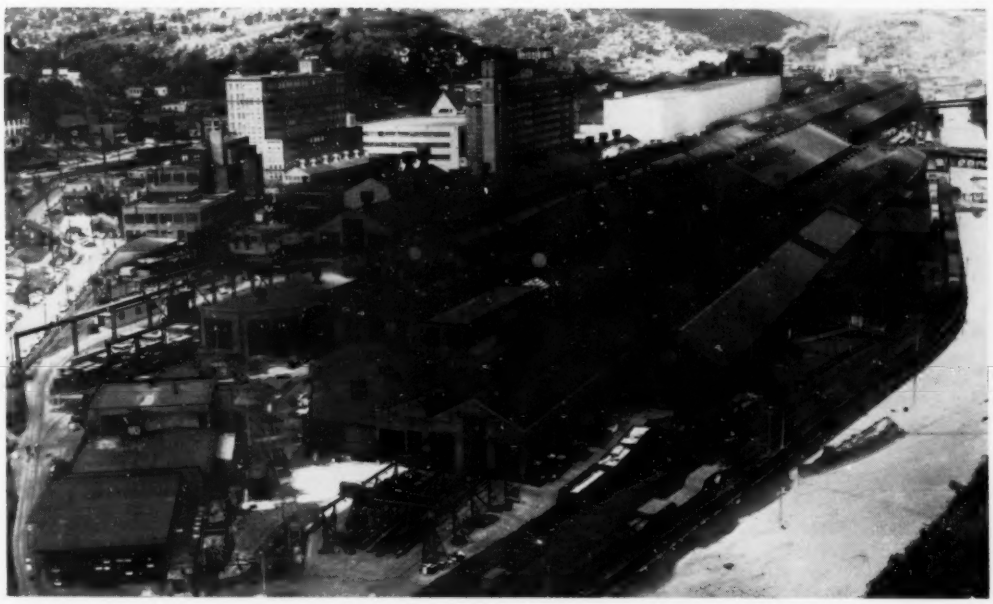

FIGURE 1—The main plant at the East Pittsburgh Div., Westinghouse Electric Corp.

MACHINE	TYPE	MODEL NO.	SIZE	LUB. CARD NO.
Welder, Semi-Auto,	Boom-Type-	Moveable Carriage		EP-864-A
MFR. Bentley Welding, Inc.			USER DIV.	CARD OF

PART	LUBRICANT	APPLICATION	AMOUNT	POINTS	FREQ. OF SERVICE	CODE *
Gear cases inside column base (A)	2727-1		Keep filled	2	Chk 3 mos Chge yrly	3 5
Boom drive gear case on rear of boom carriage	2727-1		Keep filled	1	Chk 3 mos. Chge yrly	3 5
Wire feed gear case in Weldomatic head	2727-1		½ full	1	Chk 3 mos. Chge 6 mos.	3 4
Gears inside base	12130-300				3 months	3
PGF on inside, and beneath column base (B)	12279-280		2 or 3 shots		Monthly	2
PGF on boom & carriage wheels	12279-280		"	10	Monthly	2
Clean & repack idler roller (C)	12279-280			1	3 months	3
Grease cups on wire reels	12279-280		Keep filled	1 each	Turn weekly Fill monthly	1 2
Hand oil boom feed rach & pinion, head adj. worm drives, etc.	12130-300		Keep oiled		Each shift	

SPEC. INSTS.
(A) Base traverse unit inside LH cover and column swivel lock unit inside RH cover
(B) For wheels, guide rollers, column swivel, etc.
(C) On Weldomatic Head.

BY	DATE	CHECKED BY	DATE	DATE OF LATEST REVISION
Robert C. Hamilton	11/12/58			11/17/58

MACHINE LUBRICATION SPECIFICATION - (W) FORM 28778C * CODE: 1= WEEKLY 2= MONTHLY 3=3 MOS. 4= 6 MOS. 5= YEARLY

FIGURE 2—A typical lubrication chart.

Presented at the NLGI 27th annual meeting in New Orleans, October, 1959

THE PLANT for which the author works is the largest division of his company. It is located in East Pittsburgh, Pennsylvania, and consists of several plant sites. The main plant, shown in Figure 1, has over 5,000,000 square feet of manufacturing floor space and an estimated 15,000 items of equipment to be lubricated. Of these, approximately 70 per cent need grease applied in from one to perhaps 50 or more different locations, at frequencies ranging from every two hours to once every three to five years. Methods of application include the old fashioned hand-operated screw down grease cups, pressure lever guns, push guns, spring-loaded grease cups, multiple tube header blocks and both manually- and automatically-operated centralized lubrication systems.

Our plant, which manufactures a large variety of heavy electrical equipment including large switchgear, motors and generators, can probably best be compared to an overgrown job shop. Although we do have definite production lines, the output of any one item is small, and there is little duplication of equipment. We, therefore, encounter a large variety of lubricant and lubrication problems involving the choice of lubricants and their storage, handling, dispensing and maintenance of quality.

Several years ago the practice of requiring each machine operator to lubricate his own equipment was discontinued. This was done for several reasons. First, it is virtually impossible to properly train, equip and supervise such a large force of employees. Second, many items of equipment do not have regularly assigned operators, so oilers were already in the area to service these items.

When this change in policy was made, another problem became apparent—the high rate of turn-over of lubrication personnel. As in most companies, our job classification for oilers is relatively low. When times are good, these men are constantly bidding for better paying jobs. When times are bad, the men with the most seniority move down and "bump" the oilers out of their jobs. Many of these new oilers are skilled workers and not suited by temperament for this type of

work. Their only interest in lubrication is to hold on until business improves and they can again bid for the better paying jobs. This is reasonable, but it does create a training problem.

Some of the steps taken in an attempt to alleviate these conditions have created still additional problems. It is hoped that the NLGI will be able to help solve some of these.

One of our first steps, when operator lubrication was discontinued and oiling crews were organized, was to prepare written lubrication instructions, as shown in Figure 2, for the thousands of different types of equipment to be serviced. These instructions, which are printed on 5 x 8 cards, are made as detailed as is practical. In addition to the description of the machine for which they are prepared, they show the name and location of the parts to be lubricated, the lubricant to be used, and the required frequency of application. In all probability an oiler seldom refers to these cards after he has been on the job for a few weeks. However, they serve a useful purpose in the training of new men, standardizing of lubrication practices and furnishing a written record of how each item of equipment was serviced.

Another step taken was to set up a system of scheduling oil changes, relubrications, etc. This is a subject in itself, and one which is not really within the scope of this symposium. However, a few brief remarks might be in order.

A punched card tabulating system is used for scheduling purposes. Figure 3 shows how a master tab card is prepared by keypunching on it the information supplied in a source document. Each week these cards are sorted according to a master plan and processed through a reproducer which prepares a detail card, or work order, for each machine which will require servicing during the ensuing week. These cards are fed through an interpreter which "reads" the punched holes and prints the information along the upper edge of the card. Figure 4 shows an enlargement of the master card for a welding machine and the detail card, or work order, which was prepared for the 48th week. Code

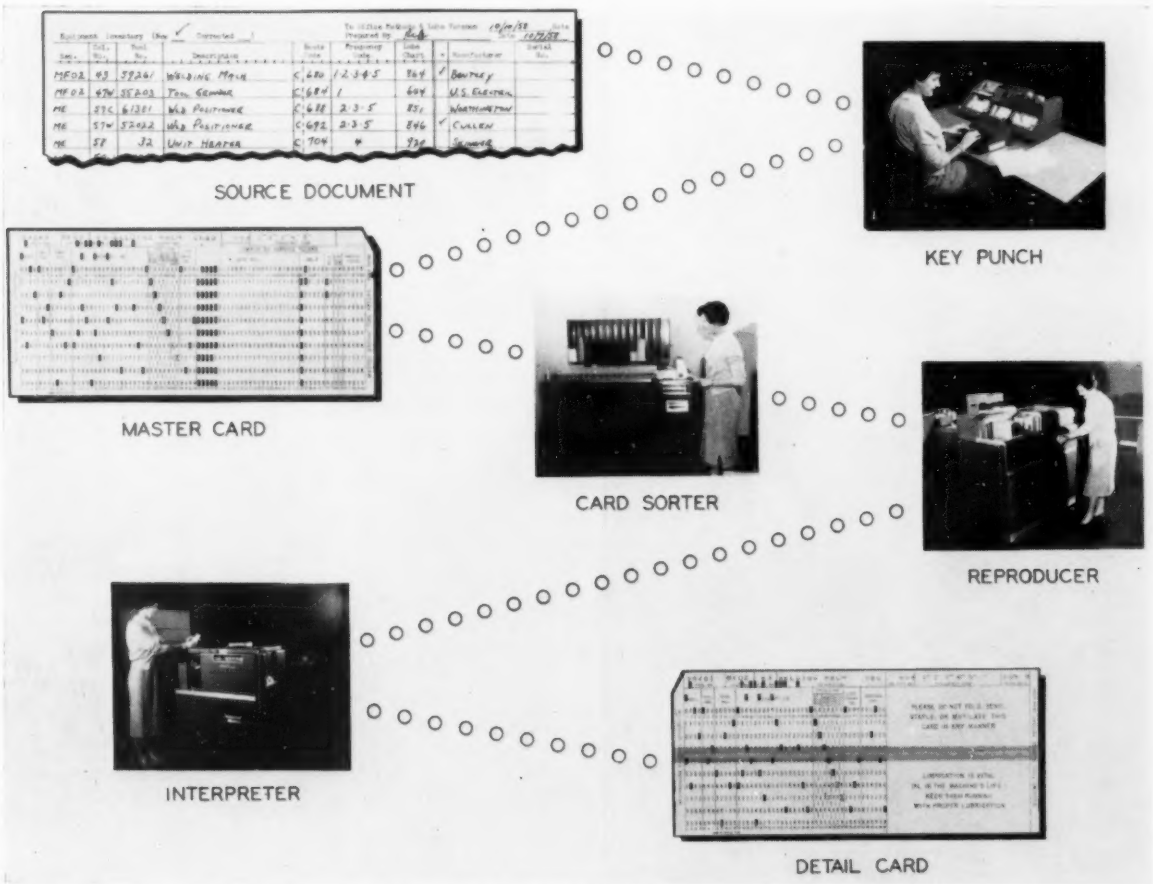

FIGURE 3—A master tab card is prepared and used for scheduling oil changes, relubrications, etc.

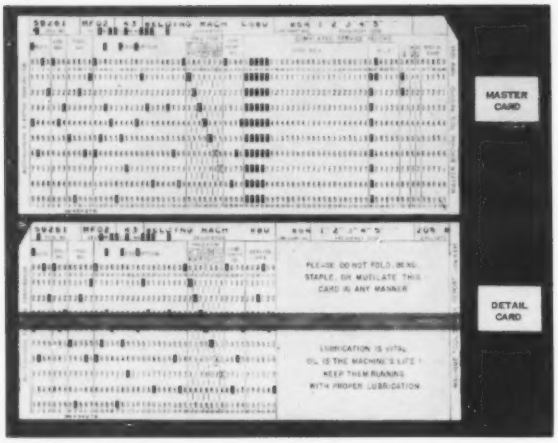

FIGURE 4—Tab cards for PM scheduling.

numbers, which appear in the frequency field, identify the actual work to be performed.

A third step taken during the establishment of our lubrication program was to provide each oiler with a cart, as shown in Figure 5, which would carry a sufficient supply of equipment and lubricants to permit him to service approximately one-half of his area before he would have to return to the oil crib to replenish his supply. The size limitations of the cart and other considerations made it necessary to standardize as much as possible on the lubricants to be used. This has resulted in the elimination of several greases and a number of oils. A lithium soap multipurpose grease is now used for approximately 95 per cent of all grease applications. About six special purpose greases make up the balance of our grease requirements.

FIGURE 5—Oiler's truck.

It is realized that each one of the many different greases on the market (one supplier alone has over 100) has its special place, and that a multipurpose grease may be of slightly lower quality in some respects. Hostler,[1] in a paper presented at the 14th Annual Meeting of ASLE, made it clear that it is very difficult, if not impossible, to combine in one product all of the desirable properties of a group of products. However, the dangers of misapplication, coupled with the problems of storage and handling, necessitate standardization to as great a degree as possible.

Since one of the most frequent causes of bearing failures is dirt, it was decided to utilize grease handling and dispensing equipment which would guarantee the cleanliness of the grease. The use of grease cartridges which can be slipped into a lever-type grease gun, much like the cartridges for caulking guns, was considered. However, this idea was soon rejected, partly because of cost and partly because of the difficulties of inventory control.

FIGURE 6—Air-operated grease transfer pump.

Instead, it was decided to purchase grease in bulk. From 400-lb. drums, one of which is located in each oil crib, the grease is transferred by means of air-operated transfer pumps, as shown in Figure 6, into portable bucket-type loader pumps. Using pumps of this type, the oiler can load his grease gun, as shown in Figure 7, through a special loader fitting without opening the gun. Thus, from the barrel to the bearing the grease is almost fully protected from external sources of contamination. Dirt can be introduced to a bearing if the loader fittings on the gun or the pressure gun fittings on the equipment are not wiped clean before servicing. However, this is a minor problem when compared with prior methods.

It is well known that the costs of application of lubricants are usually greater than the cost of the lubricants themselves. In our plant the ratio is about 4½ to 1. One possible way to reduce these costs is to use the rela-

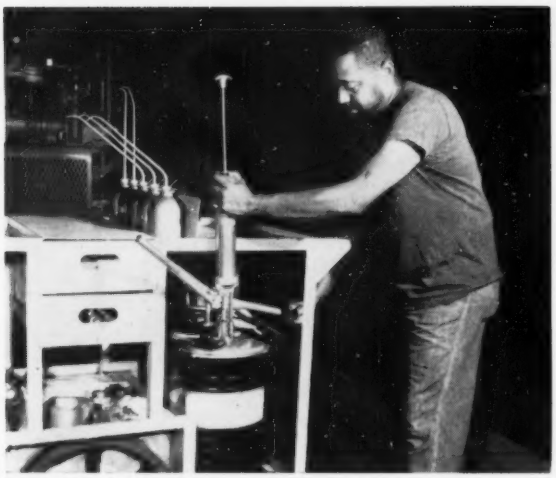

FIGURE 7—Filling the gun from the loader pump.

tively new "moly" or other extended service greases. However, the high cost of these products usually prohibits their use except under extenuating circumstances.

Another way to reduce the costs of application is by the use of labor saving devices. At one time the familiar hand-operated screw down grease cup, shown in Figure 8, was used extensively. However, these cups will not feed grease except when the cap is turned, and this should be done quite frequently. Although the cap can usually be turned more quickly than a gun can be used, this time saving is probably more than offset by the time required to periodically unscrew the cap (which has a fine thread), fill it and screw it on again. Other disadvantages are that they are usually filled by paddling, which exposes the grease to possible contamination, and they develop only a very small amount of pressure, which may not be adequate for modern, close fitting bearings. It is also possible, if a fibrous grease is used, for a bearing to pull all the grease out of the cup.

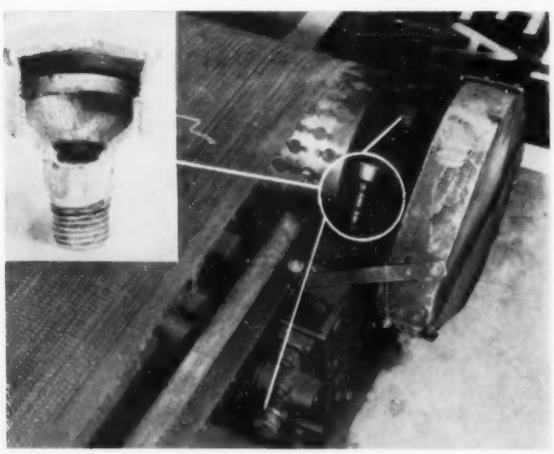

FIGURE 8—Screw-down grease cups on conveyor pulley bearings.

Various types of grease fittings, as shown in Figure 9, have been developed over the years and are now usually used in place of the cups just mentioned. These have several advantages. The standard hydraulic fitting, for example, is small and rugged and, therefore, not too easily broken or damaged. A grease gun can be attached to and released from this fitting very quickly and pressures up to 8,000 to 10,000 lbs. can be developed, thus forcing lubricant into tight bearings.

The flush fitting, of course, is used on moving parts where a protruding part would create a safety hazard. The pin type and button head fittings are designed so that the gun coupling will lock on more positively than on the hydraulic fitting. Most fittings of these types have ball checks to prevent back-flow and to exclude dirt.

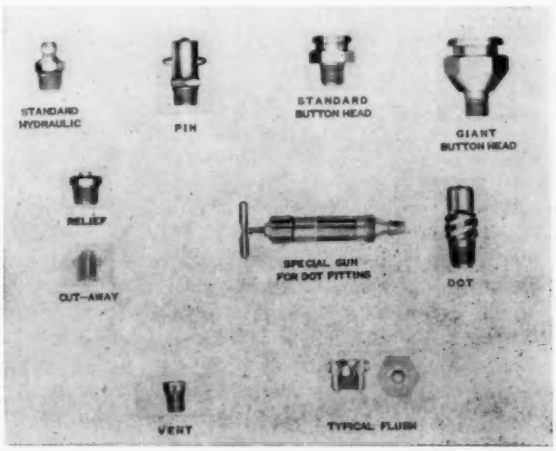

FIGURE 9—Various types of grease fittings.

It is possible to standardize on the use of different fittings for different lubricants, if desirable, thus helping to prevent their misapplication. Or, if desired, different fittings can be used for different frequencies of application.

Several types of spring-loaded grease cups, similar to the ones shown in Figure 10, are often used to reduce the frequency of servicing. These consist of reservoirs with spring-loaded follower plates or pistons which exert a continuing, though diminishing, pressure on the grease. They are filled by means of a conventional grease gun which is applied to a standard grease fitting on the side of the cup. Other refinements found on some such devices are rate-of-feed adjustments and indicators to show the amount of grease in the reservoir.

A few spring-loaded grease cups are used in our plant, and we would like to use more. However, it is reported that a few years ago we experienced several failures of bearings which were so equipped. These may have been due to any one of several causes. For one, the

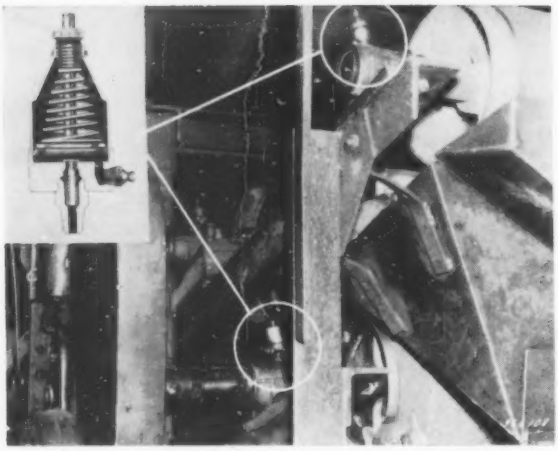

FIGURE 10—Spring-loaded grease cups on conveyor pulley bearings.

feed holes in the stems of the particular cups used were very small, in the order of $\frac{1}{32}$ inch diameter. These could easily plug up with some contaminant. It is also possible that excessive bleeding occurred, since the grease was under constant pressure from the spring-loaded piston, and that a soap rich fraction partially or completely restricted the flow of grease to the bearing. There have been some reports that lithium soap greases, such as the one we use, are susceptible to accelerated bleeding under such conditions. In fact, at least one manufacturer definitely warns against the use of lithium greases in cups of this type.

Header blocks are frequently used to reduce the cost of servicing equipment. As shown in Figure 11, a number of grease fittings are grouped together in one block, which is mounted in a convenient location. Copper tubes are used to connect each fitting to the bearing it services. This method eliminates the need for shutting down the equipment, eliminates climbing and improves

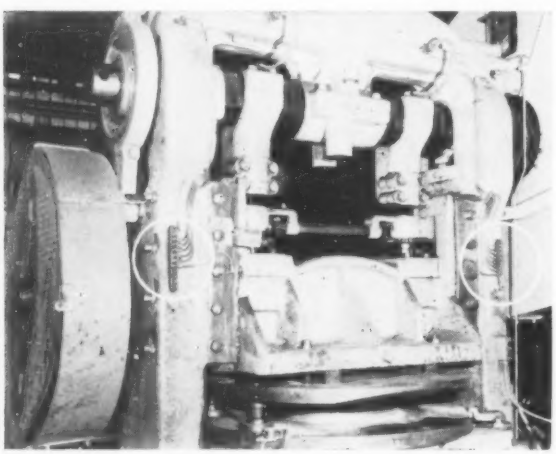

FIGURE 11—Grease header blocks on punch press.

safety. However, it does not eliminate other disadvantages of hand lubrication.

As stated a moment ago, hand lubrication is costly. This is true not only because of the labor of application, but for other reasons as well. Easy-to-reach bearings are generally "flooded," which results in waste and in the case of anti-friction bearings, may cause premature failure. Excessive pressures can also be developed, resulting in broken bearing seals and damaged windings, in the case of electric motors. An example of this is shown in Figure 12. Furthermore, this method often requires that a machine be shut down while it is being lubricated, thus resulting in curtailed production.

The development and use of centralized lubrication systems has largely eliminated the lack of control over quantity applied and the dependence upon the human element, and has made possible the positive and uniform distribution of lubricants to many points, including moving parts. This frequently makes it possible to lu-

FIGURE 12—Burned-out motor caused by over greasing.

bricate an entire machine, or even groups of machines, from one central station, with the assurance that no hard-to-reach bearings will be overlooked or neglected. An added advantage is that it simplifies the task of training oilers. Figure 13 shows one of several systems of this type, in which a central pumping station is used to force the lubricant through main lines to metering valves. These valves, which are available in different sizes and which in some cases are adjustable, deliver measured quantities of lubricant through discharge lines to the bearings.

The ultimate in such systems is to have them automatically, rather than manually, operated and equipped with numerous devices to indicate low lubricant level, malfunctioning of the system, etc.

Centralized lubrication systems are very diverse in design. Some types are completely hydraulic in operation, while others use springs to either discharge the lubricant or to reset the measuring chambers for the next discharge. Some rely upon moving pistons to cover or uncover ports, while others rely upon check valves of various types to direct the flow of lubricant.

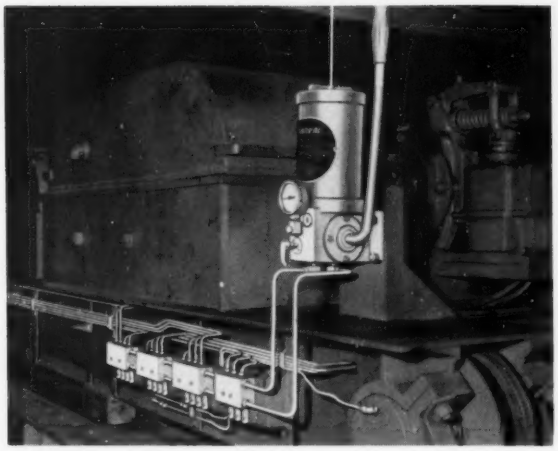

FIGURE 13—Centralized lubrication on a bridge crane trolley.

Mechanically, the various designs of centralized lubrication systems are very sound. This is proved by their many successful applications over a number of years. However, difficulties have been experienced when certain lubricants have been used. One of these has already been mentioned—that of excessive bleeding when certain greases are forced under pressure through small orifices. Although there seems to be some controversy over this, one lubrication engineer has reported that his company has had to discontinue using one grease in particular systems due to plugging of the lines by hard soap deposits. The author, however, has not experienced any such trouble in his plant.

Another difficulty encountered when we talk to suppliers of these systems is that there is not, at the present time, an adequate test for measuring the pumpability characteristics of different greases and relating them to the length and diameter of lines. That is, we cannot readily measure and compare the abilities of various greases to flow under pressure through the lines and fittings of a grease dispensing system. As reported by Aarons and Warren[2] and many others, the flow properties of greases differ since their apparent viscosities change by varying amounts when subjected to different shear rates and temperatures. Obviously, the texture of the grease has a bearing on its apparent viscosity, and therefore its pumpability. Hostler[1] reports that a long fibred soda soap grease is very difficult to pump as the fibres tend to ball up, thus adding more resistance in the lines. One of the purposes of this symposium is to discuss such problems as these.

A sales engineer, when designing a centralized lubrication system, will always ask, "What grease do you intend to use?" Sometimes, if he has had experience with that particular brand, he knows whether or not it will work in the intended application. If he is not familiar with the product, how can he know it will work? Knowing the consistency of a product is of little value, according to Rotter,[3] who states that an NLGI No. 2 grease sometimes pumps better than a No. 1 grease. Even worse is the fact that one grease may change consistency very little with temperature while another, of the same NLGI consistency, will change severely.

Actually, each manufacturer of centralized lubrication systems has developed charts which give the pressure drops in lines of various diameters as a function of pumping rate, or the maximum lengths of supply lines of different sizes when used with greases of various consistencies and at several temperatures. These charts are necessarily very conservative, and meaningless terms, such as "normal" and "low" to describe temperatures and "soft" and "medium" to describe a typical grease, are used.

Rotter,[3] in a paper presented before this group several years ago, showed a slide entitled "A Dream," in which the output of a particular dispensing system was plotted against apparent viscosity for various pumping pressures. Speaking as a user of both lubricants and lubrication equipment, the author would like to repeat and emphasize Rotter's statement that there is a definite need for a scheme for greases "—which will perform for all practical purposes as well as the Oil Viscosity-Output Charts have done."

The average person concerned with shop lubrication problems is not in a position to use a complicated formula based upon the definitions of apparent viscosity, shear stress and shear rate. What he needs is a simple method for determining line sizes, pumping pressures or output, based upon data made available to him by the suppliers of both the lubricant and the dispensing system he intends to use. This method should be graphic, using one or perhaps a series of simple charts or nomographs.

The author believes that this can be done if universally acceptable laboratory tests, having good correlation with actual operating conditions, are developed.

Since the necessary information is not readily available at the present time, one must either "play it safe" and possibly over design the installation or else, as is sometimes done, experiment in the shop with a "mock-up" installation. Of course, in some cases lines are purposely made over-size to allow for possible future expansion of the system.

It might interest some of you to know that this same problem was discussed at a meeting of the Joint Technical Committee of the ASLE during their 14th Annual Meeting in April of this year. It was stated at that time that there was a very definite need for a summary of available information on the pumpability of various lubricants, minimum pipe sizes, etc. Since much of this information is already available from a number of sources, it was suggested that this information be gathered, consolidated and published in the *Handbook for*

Lubrication Engineers which is now in preparation.

In addition to pumpability, feedability is another grease characteristic about which more should be known. The term has been defined by the NLGI Committee on Definitions as follows: "Feedability is the ability of a lubricating grease to flow to the suction of a dispensing pump at a rate at least equal to pump delivery capacity." Some people call this property "slumpability."

It is known that some lubricating greases do not feed satisfactorily and thus cause cavitation at the inlet to a dispensing pump. This is the reason that most manufacturers use a follower plate in their pump reservoirs. Some even utilize spring-loaded follower plates. These would not be necessary if it were known that a grease of good feedability characteristics was to be used. The elimination of the spring would in turn lessen the danger of grease separation in the reservoir.

Greases with poor feedability are also troublesome back in the oil crib, in that cavitation may occur if an air-operated transfer pump is used. Again, follower plates are almost always used to prevent this from happening.

Poor feedability can also result in excessive waste. Waite,[5] of Inland Steel Co., reports that a careful survey in his company established that drums were being returned to the supplier with an average of fifteen pounds of product retained in each. This represented a loss of two and one-half dollars per drum. An attempt to recover this grease by scraping it into the next drum with a hoe would not only be costly, but would be awkward and messy and would expose the grease to possible contamination. This loss of grease could be greatly reduced by the use of a follower plate equipped with an inflatable ring. It is reported that this device will wipe clean the sides of even dented drums.

One investigator[6] has reported that his investigations have revealed that the consistency of a grease, as measured by the grease penetrometer, does not necessarily indicate how the grease will perform in a prelubricated bearing. However, a slumping test is one of several tests which can be used for this purpose. This test, it is reported, will indicate whether a grease will channel near the bearing seals, or will feed into the path of the rotating balls and ball cages. It will also indicate the tendency of the grease to leak through bearing seals.

If his observations are correct, it is believed that the development and standardization of a procedure for testing the slumpability (or feedability) characteristics of a grease would be of value in these two cases.

One additional point, which is perhaps outside the stated purpose of this symposium, should be mentioned in closing. There is a need to standardize on a number of other lubricant tests and for lubricant suppliers to more realistically evaluate their products. The author has just recently completed a series of tests to determine which of several highly rated, high temperature lubricants could be expected to adequately lubricate oven car wheel bearings exposed to temperatures up to about 450° F. Most of the oils and greases tested formed very hard, brittle deposits; only two gave any indication that they might be satisfactory. This should not be considered to be a reflection on the integrity of the suppliers. Rather, it is believed that they have mistakenly assumed that a lubricant which will hold up in a rotating bearing at high temperature will hold up equally well in a bearing which is not rotating when exposed to heat, or that lubricants adequate for one application at extreme temperatures are suitable for all applications at these temperatures.

In terms of pounds of grease used (about 8500 lbs. annually) the author's plant is probably considered small. At least, it is small compared to some of the other plants represented here today. However, it is believed the problems we face are common and are just as important to the corner filling station as they are to the largest plant in the world.

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About the Author

R. C. Garretson *received a BS degree in chemistry from the University of Illinois in 1939 and a BS degree in chemical engineering from the University of Michigan in 1940. After war service, he joined International Harvester Co. in 1946. His duties there involved standardization on use of cutting fluids and drawing compounds, and organization of a plant lubrication program. In 1954, Mr. Garretson joined Westinghouse Electric Corp. as a lubrication engineer in the materials engineering department. In 1958, he became plant lubrication engineer for the company's East Pittsburgh division. Mr. Garretson is a member of the Lubrication Practices committee of ASLE.*

Transportation Savings

By: F. A. Van Alden

Battenfeld Grease & Oil Corp., Inc.

Presented at the IOCA 12th annual meeting, Chicago, September, 1959

TRANSPORTATION and Traffic Management has grown, I believe, just since the war and is a fertile field for savings to any company with any amount of shipping or receiving to speak of.

The grain companies, oil companies, auto manufacturers and allied firms have had traffic departments and traffic specialists for many years. Many more firms now give greater attention to traffic in their business with the rise in freight costs and their competitors offering products at a delivered price including freight.

The reason transportation is such a good field in which to look for savings is that freight rates are so complicated today. The only rates that are easily determined are Parcel Post and Railway Express. These rates are published on a scale system and anyone can be shown, in a few minutes, how to determine the rates to all parts of the country.

On the other hand, railroad and truck line rates and intra-state and inter-state rates are published in tariffs that would fill a small library. Some firms publish territorial directories for sale to the public which lists the tariffs your rates will be found in. You might be able to find a rate in a certain tariff covering a commodity from, let's say, Omaha, Nebraska, to Cleveland, Ohio, but an exception tariff might be in existence which publishes a lower rate.

Rates are not all based on mileage or the distance of the move. They take into consideration the value of the commodity, susceptibility to damage, competition with other producing areas and many other factors.

There are class rates covering all commodities published by rail and truck lines on volume and small shipment traffic. But, in addition to this, there are commodity rates published in other tariffs that were established because one shipper had a large volume of a particular commodity going from one origin to a particular destination.

If you call a rate clerk of a rail or truck carrier and request the truckload or carload rate from Chicago to Pittsburgh, Pennsylvania, he may or may not take the time to dig into the matter to determine whether or not a lower commodity rate has ever been published on your commodity between the two points you are interested in.

Traffic Counselors

There are freight rate companies and traffic counselors who will check your rates for you and assist and advise you in traffic matters, for those firms that are not large enough to require the full time service of a traffic manager or traffic department. These firms will check your bills before they are paid, for a monthly fee; or, will audit them after they are paid for a percentage of the savings to you in the form of overcharge claims against the carriers.

Should you employ one of these firms, I recommend that you followup from time to time to see if any savings have been effected. If there are no savings, and the truck lines and railroads in your city are doing a pretty good job of assessing the correct rates, there is no point in continuing the service. Of course, it will cost you nothing to have your old bills re-audited. If mistakes are found, you get part of the refund and the auditing firm gets part of it. If your bills are correct, there is no charge.

In our traffic department, we often enjoy large savings by checking extensions of freight bills. The carriers extend thousands of bills a day and it is not uncommon for us to find an error of $100.00 when multiplying the weight times the rate to come up with the total freight bill.

Demurrage

Demurrage is another field for savings. We unload some heavy oils at our plant and, in the wintertime, it is necessary to apply steam to heat the oil before the car can be pumped. Many oils, such as brite stock, even have to be steamed in the summer and the car must be held three or four days.

In reading the demurrage tariff one day, I found one item that gives a receiver two extra free days for pumping cars containing "heavy or congealed lading." If some of these oils have to be steamed, or even if in your opinion steaming would make them easier to pump, you can request his additional free time.

We spend a lot of time in our department checking the monthly list of cars to be sure that our records agree with the railroads. The demurrage clerk for the railroad may show a car set before 7:00 a.m. on July 1, but your records show the engine did not bring the car up until 7:30 a.m. This entitles you to another free day since the first free day is the first 7:00 a.m. after car was set.

LCL and LTL Traffic

LCL traffic, the movement of less than carload shipments, compared to LTL, less than truckload shipments, is a vast field. Generally, LCL traffic has received some serious setbacks. Recently, the Chicago Northwestern discontinued free pickup and delivery. This road was followed by the Chicago Great Western. By cancelling free pickup and delivery, they have virtually gone out of the LCL business because you must pay a transfer company to deliver the shipment to the railroad and, the consignee must pay to have it delivered at destination.

Generally speaking, rail LCL is approximately ten cents cheaper than LTL truck shipments but the service is generally not so good. If you can count on more time in transit for your shipments, you can effect a little savings by using rail service.

Jumbo Tank Cars

Many changes have been brought about in rates by carriers wishing to protect their business from going to barges, by putting in lower rates on "Jumbo" or 20,000 gallon tank cars. I am not an authority on barge traffic but I do know that competitive rail rates have been put into effect, based on such competition. If you happen to have barge competition, you should bring it to the attention of whoever looks after your traffic interests and, perhaps you can have your rail rates lowered.

DF Loaders

For those who ship by carload, the DF Loader is a great saving. The DF, or damage free, loader is a new car furnished by the railroad, equipped with wooden deck boards and 4 inch x 4 inch steel reinforced wood bulkheads to hold shipments in place during transit time. Although it takes a little longer to put the equipment in place and load the car, the elimination of damage and the savings in lumber and steel strappings more than offsets the additional time in loading.

You can check with your local railroad agent as to the availability of these cars. Sometimes they may have a DF car belonging to some other railroad that could be loaded in the direction you are going. These cars are used by the railroads to get new business and, they are furnished by the carrier at no extra cost, providing the railroad owning the car gets a road haul.

Manufacturing in Transit

By far, the greatest savings in transportation are to be found in transit. The first transit privilege was established in 1879 at Nashville, Tennessee. Here, a practice of re-billing or re-shipping grain was inaugurated. Grain is shipped into a market area, turned into flour and re-shipped on the through rate. The railroads give the shipper the benefit of the through rate if the material comes in by rail and the finished product goes out by rail.

Later, transit was established on many items such as steel, furniture, corn syrup and such products as come in to the manufacturing point as raw materials and go out as a finished product.

In 1953, transit was authorized on petroleum and petroleum products, on oil originating in Kansas, Texas and Oklahoma and manufactured into grease, or on oil blended or compounded, or on oil simply canned or barrelled at some intermediate point and then shipped on to points generally on an in-line haul or more or less direct relation to the origin. You cannot, for example, ship the oil back into the area where it came from.

Later, the transit privilege was broadened so that oil coming from the East could be used on shipments going to Texas, Oklahoma, and the South and points in a direct line of movement.

For those who do not know how the transit privilege works, let me explain briefly. As a hypothetical case, let us assume that we are receiving oil from Tulsa, Oklahoma, and have a transit privilege at Kansas City, Missouri, and are shipping a car of oil to Des Moines, Iowa. The tank car of oil will come in from Tulsa, Oklahoma, and be packaged and sent on to Des Moines in a box car.

First, you must get the carload rate from Tulsa, Oklahoma to Des Moines, Iowa, on packaged goods; that is, cases or drums. Let's say again, for hypothetical purposes, that the rate on packaged goods is fifty cents. Now, we will have to take the tank car rate on oil from Tulsa to Kansas City, which we shall say is thirty-five cents. Therefore, you see that there is a difference of fifteen cents per 100 pounds between the package rate to Des Moines and the tank car rate to Kansas City.

Your inbound tank car freight bills are recorded at Kansas City. When your outbound shipment to Des Moines is made, you can surrender the inbound freight bill for thirty-five cents and the railroad will allow you to subtract the thirty-five cents paid in from the fifty cent through rate, giving you a balance out rate of fifteen cents plus a six and one-half cent transit charge for a total rate of twenty-one and one-half cents.

Besides this saving, the tank car moves into Kansas City on the basis of estimated weight of 6.6 pounds per gallon and moves out in packages, based on an average weight of 8½ pounds per gallon, which gives you an additional savings of 1 and 9/10 pounds per gallon. In many cases transit offers a savings of as much as two

or more cents per gallon and in some exceptional cases four or five cents per gallon.

You may not have transit approved for your particular area, but you can apply for it through your railroad representative or through a traffic counseling service.

The past year has been a busy one for rate proposals, new transit privileges and changes in rates. It behooves us all to keep posted on these changes. Most railroads will put you on the mailing list of new rate proposals being suggested. Once it is announced that a proposal will be considered by one of the rate making bodies, those shippers or receivers who are interested may publicly, or in writing, object to, or add their support to, the proposal.

If someone who is a competitor of yours requests a reduced rate, from let's say Kansas City, Missouri, to Chicago, Illinois, and you are located at St. Louis, Missouri, you can ask for the same rate from St. Louis that your competition has requested. It is more than likely you will get the same rate, or both petitions will be denied. However, if you fail to make your position known your competition will have an edge on you freight-wise.

Someone in your organization, either your traffic man or someone interested in such matters should read these proposals and write or appear in person to defend your company in these various rate changes.■

About the Author

F. A. Van Alden *studied transportation, traffic management and interstate commerce law at the University of Kansas City. He was admitted to practice before the ICC in 1952. Mr. Van Alden obtained his first job in traffic at the Chevrolet plant in Kansas City in 1946, working in claims and rates on new automobiles. In 1952, he started work at the Ford aircraft plant in Claycomo, Mo. He joined Battenfeld as traffic manager in 1954. Mr. Van Alden belongs to the Transportation club of Kansas City and the Industrial Traffic Managers of Kansas City, Inc. He is also a member of the transportation committee of the Chamber of Commerce of Kansas City.*

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Titre	134.5°-138°F
Color 5¼" Lovibond Red	2.0 max.
Color 5¼" Lovibond Yellow	10 max.
Unsaponifiable	0.75% max.
Saponification Value	204-207
Acid Value	203-206
Iodine Value (WIJS)	4-6

a. gross & COMPANY

ALWAYS MEASURABLY BETTER THAN THE SPECIFICATIONS CALL FOR

COMPOSITION

Myristic Acid	3%
Palmitic Acid	29%
Stearic Acid	63%
Oleic Acid	5%
Linolenic Acid	1%

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Literature and Patent Abstracts

Composition

Lubricating Greases in Which a Portion of the Fluid Is a Polymer of Perfluorochloroolefin

In British Patent 824,342, Minnesota Mining & Manufacturing Co. describes lubricating fluids which have high load-carrying ability, are resistant to corrosive chemicals and are useful at temperatures from −55 to 200° C. Such fluids consist of mixtures of silicone oils, esters or hydrocarbon lubricating oils with five or ten per cent by weight of certain fractions of homo- or cotelomers of compounds such as trifluorochloroethylene.

Also such fluids can be thickened to form lubricating greases by the addition of silicas or modified bentonites. Another suggested thickener is a metal salt of an organic perfluorochlorocarboxylic acid. These acids may be prepared from fluorochlorocarbon oils by hydrolysis with fuming sulfuric acid at temperatures between 140 and 210°C for five to 25 hours.

Thus a lubricating grease was prepared from 20 grams of a fraction of the polymer formed from trifluorochloroethylene, 70 grams of a Pennsylvania SAE 80-90 gear oil and 10 grams of Estersil GT. The product was said to have a satisfactory test on the Shell Four-Ball Tester, but no other characteristics were given.

Blended Mixed Base Lubricating Greases

According to Morway (U. S. Patent 2,918,431, assigned to Esso Research & Engineering Co.), lubricating greases with satisfactory water resistance, high dropping points and long bearing life are formed by blending two components or by preparing the two lubricating greases sequentially in the same vessel. One type of lubricant consists of a

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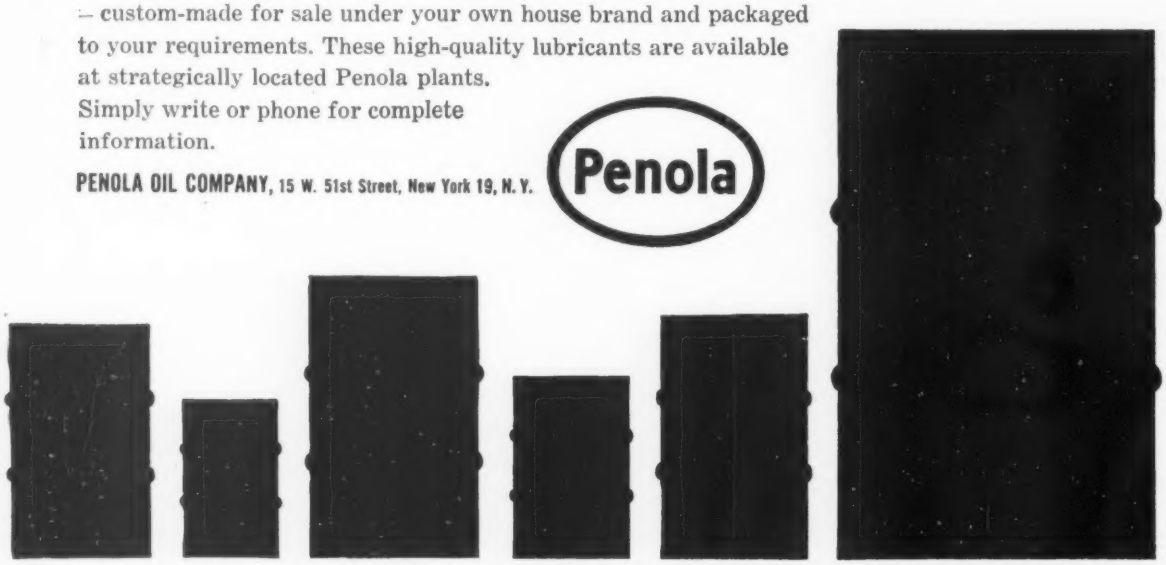

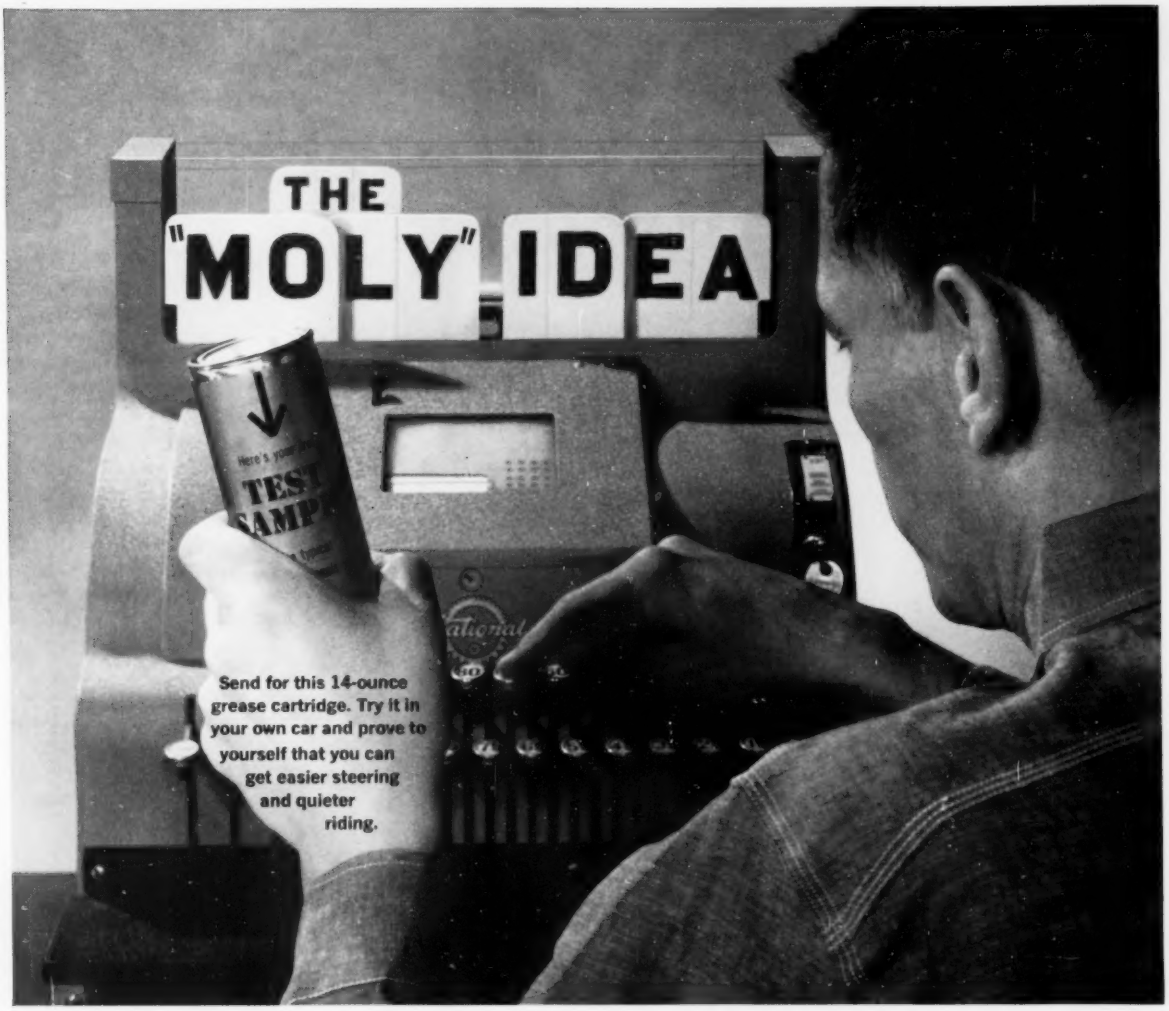
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Grease sells gasoline!

Grease can increase service station traffic and sales. Grease can sell gasoline! • That's the "MOLY" IDEA. • And it works.

Oil marketers have tried it. They've recorded increases in service station, in traffic, gas sales, grease sales, and TBA sales. So they've repeated it. And made "MOLY" grease their standard product.

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Because smart marketers know that a new product is their big opportunity for dramatic promotion. The new product is their own brand grease with Molysulfide added, giving them the first grease in years they can talk about and promote . . . the lube job a customer can appreciate with his hands, his ears, and his pocketbook. Because "Moly" grease makes steering easier, riding quieter, and it reduces wear. Most important . . . you can translate these technical benefits into your customer's language!

Have you looked into the sales potential of the "MOLY" IDEA? Have you counted up the benefits to your company, your dealers, and your customers? Have you thought about the opportunities for local promotion and increased traffic that this new grease can give you? If not, remember: "Moly" grease has grown faster than any other product in the history of the grease industry. You can profit by this growth.

We'll be happy to send you the facts. Write for details supporting THE "MOLY" IDEA, to Climax Molybdenum Company, a Division of American Metal Climax, Inc., 1270 Avenue of the Americas, New York 20, N. Y.

CLIMAX MOLYBDENUM COMPANY

A division of American Metal Climax

1270 Avenue of the Americas, New York 20, N. Y.

sodium soap-salt complex thickened oil and the other type is a calcium mixed salt thickened oil. The two types can be blended in proportions of 25 to 75 per cent of either.

The sodium base product is made by reacting rapeseed oil with an excess of sodium hydroxide in the following sequence. Saponification of the rapeseed oil releases glycerine by hydrolysis and this glycerine is dehydrated at temperatures above 425°F forming acrolein. This acrolein in turn, by alkali fusion, is converted to sodium acrylate which, mixed with soap of the rapeseed acids forms the thickener for the lubricating grease. It is thought that some sodium formate, sodium acetate, sodium propionate, etc. may also be formed.

For example, a lubricant was prepared from the following weight per cents: rapeseed oil, 24; sodium hydroxide, 5; mineral oils of 55 SUS at 210°F, 39.5, 2200 SUS at 100°F, 5.25, and solvent refined 367 SUS at 100°F, 24.75; phenyl alpha naphthylamine, 1; and metal deactivator, 0.5. The rapeseed oil and the first fraction of oil were warmed in a fire-heated kettle to 150°F before addition of the sodium hydroxide as a 40 per cent water solution. Next, the temperature was raised to 360°F where the mass was dehydrated before further heating to 425°F where foaming started. The temperature was increased to 500°F and held at this temperature until foaming ceased when the remainder of the oil was added, the mass cooled to 180°F and the inhibitors added.

A calcium base lubricating grease was made from the following: glacial acetic acid, 12 per cent; commercial caprylic acid, 6 per cent; hydrated lime, 9.8 per cent; mineral oil of 55 SUS at 210°F, 70.7 per cent; phenyl alpha naphthylamine, 1 per cent; and metal deactivator, 0.5 per cent. The lime and oil were first mixed before addition of the acids after which the temperature was raised to 460 to 480°F. Finally the mass was cooled to 200°F before adding the inhibitors and cooling further to 150°F where it was homogenized.

The above products as well as a 50/50 mixture of the two had worked penetrations of 300 to 305. In bearing tests operating at 10,000 rpm and 250°F the lives of the lubricating greases were sodium base 3900 hours, calcium base 2400 hours and mixed base over 5500 hours.

Inorganic Grease Thickeners Consisting Of Clay Treated With a Polylactam

Clay-thickened lubricating greases which are both resistant to water and high temperature disintegration can be prepared if the clay is coated with a polylactam. Preiss, who suggests such compositions in U. S. Patent 2,917,457, assigned to Shell Development Co., describes the preparation of a typical lubricating grease as follows: A 2 per cent water slurry of hectorite clay from which the gangue had been separated was acidified by the addition of 7 per cent, based on the weight of the clay, of 85 per cent phosphoric acid. To this mixture was added 100 per cent by weight, based on the clay, of epsilon-caprolactam. The coated clay was then dehydrated

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by replacement of the water with isopropyl alcohol through a series of filtrations and alcohol washes. The alcohol was finally replaced by the addition of DC-550 silicone oil and the alcohol removed by evaporation.

This gave a lubricating grease which was then heat treated at a temperature of 400 to 450°F for about twelve hours in an atmosphere of nitrogen. During this treatment, polymerization of the lactam occurred on the surface of the clay and the resulting product was highly resistant to the action of water.

The final lubricating grease gave a bleed of 3 per cent of fluid in two hours at 300°F. A thin film spread on a metal plate and placed in a forced draft oven at 450°F lost 18 per cent after twenty-four hours but the appearance of the sample was unchanged. Tested in a bearing at 10,000 rpm and 500°F, proper operation continued for at least 80 hours.

Polypropylene Lubricating Greases

According to Morway, Seelbach and Lippincott (U. S. Patent 2,917,458, assigned to Esso Research & Engineering Co.) lubricating greases which have good adhesiveness, stringiness and splatter-resistance, besides extreme pressure and anti-wear properties, result if certain polypropylenes are included with soap-salt thickeners and lubricating oils to form lubricating greases.

An oil-soluble amorphous polypropylene having a molecular weight in the range of 300 to 10,000 is used as an aid in dispersing an isotatic polypropylene having a molecular weight in the range of 100,000 to 1,000,000 and a melting point of 250 to 410°F. The ratio of the amorphous to the isotactic polymer is at least 10 to 1. It is possible to use the dispersion of the high molecular weight polypropylene in the low molecular weight polymer as the entire lubricating fluid in a grease.

For example, a lubricating grease was made from 8 per cent glacial

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acetic acid, 4 per cent coconut fatty acids, 6.5 per cent hydrated lime, 1 per cent phenyl alpha naphthylamine and 80.5 per cent dispersion of crystalline polypropylene in amorphous polypropylene. The product had a dropping point of 500°F, a worked penetration of 310, was adhesive to metal surfaces, did not splatter and had a string of five inches.

Lubricating Greases Containing Salts Of Substituted Phosphonic Acid

Esso Research & Engineering Co. in British Patent 824,612 describes lubricating greases in which the thickener consists of calcium or sodium complexes in which the acids forming the complex may consist of low, intermediate or high molecular weight carboxylic together with 1-hydroxy alkyl phosphonic acids.

A typical product was prepared by mixing 2 wt. per cent of 1-hydroxy - 1 - methylethyl phosphonic acid, 4 per cent Hydrofol 50 acids, 10 per cent hydrated lime and 71 per cent of a lubricating oil with a viscosity of 55 SUS at 210°F. Twelve per cent of glacial acetic acid was added to this mixture and after mixing for a half-hour the mass was heated to 460°F at the rate of 3° per minute. Heating was then discontinued and the lubricant was allowed to cool to 250°F before the addition of one per cent of phenyl alpha naphthylamine. After further cooling to 150°F, the product was passed through a Gaulin homogenizer at 6000 psi.

The resulting lubricating grease had a dropping point of 500+ F, a worked penetration of 310, and a lubricating life of over 1500 hours in a bearing operating at 10,000 rpm and 250°F. Also the lubricant gave a pass at a 45-lb. load on the Timken Machine Test.

Modified Clay Thickeners for Aromatic Oils

Modified bentonites which are more satisfactory for gelling aromatic oils than is Bentone 34 are described by Burns and Goldenburg in U. S. Patent 2,920,043, assigned to Nalco Chemical Co. The improvement consists of use of a 1-,2-substituted imidazolinium salt as a cation exchange compound to render the clay water-repellent.

An example is given of an aromatic oil having an aniline number of 82.1 in which six per cent of the suggested oleophilic clay gave a clear lubricating grease with a penetration of 261. Using the same oil and ten per cent of Bentone 34, a hazy product resulted with a penetration of 390.

Mixed Base Lubricating Grease

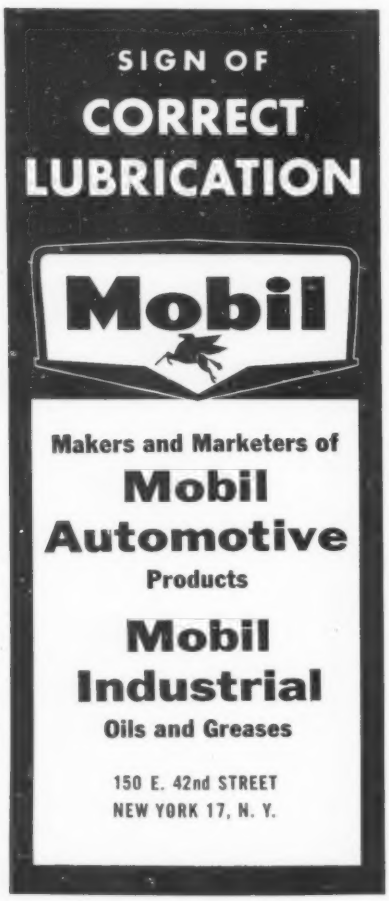
A U. S. reissue 24,681 of patent 2,842,493 has been granted to Butcosk and assigned to Socony Mobil Oil Co. The change permitted is a mole ratio of lithium to calcium soaps of from 27:1 to 4:1 in place of 6:1 in the latter instance.

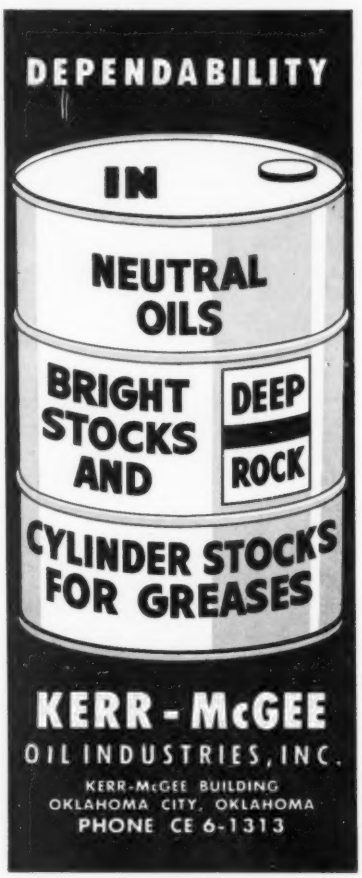
Ashless Lubricating Greases

Nussbaum in French Patent 1,119,412 describes a lubricating grease which has no ash and also has resistance to high pressures. This consists of 40 per cent of montan wax, 30 per cent of petrolatum, 15 per cent of dibutylene glycol phthalate, 10 per cent of diethyl phthalate and 5 per cent of tributyl phosphate.

Mixed Base Lubricating Greases

Addition of approximately 0.25 per cent of calcium phosphate to lubricating greases in which the thickener consists of mixed lithium-calcium soaps is said by Metenier (French Patent 1,126,601, assigned to Esso Standard Societe anon. francaise) to retard oxidation.





Composition and Process

Water Resistant Lubricating Grease Thickened With Silica

Eastman in U. S. Patent 2,920,-042, assigned to Texaco, Inc., describes a method whereby coarse particles of inorganic materials, preferably silicas, can be coated with silicone fluid and also reduced in size. This consists of preparing a slurry of the solid with 0.5 to 5 per cent of silicone fluid, based on the dry silica, and water or an oil. This slurry is then vaporized and led through tubes where the turbulent flow reduces the size of the particles.

Thus, a slurry consisting of 15.84 weight per cent of silica gel, 1.75 per cent dimethyl silicone based on the dry weight of the gel, and water were pumped through a heating coil where the temperature was raised to 700°F. The vaporous dispersion was released through an orifice into tubing where the flow reduced the silica particles in size.

Fifteen per cent of this recovered silica was mixed with 85 per cent of 300 pale oil to form a lubricating grease showing a loss of 2.5 per cent in a dynamic water-resistant test.

Additive

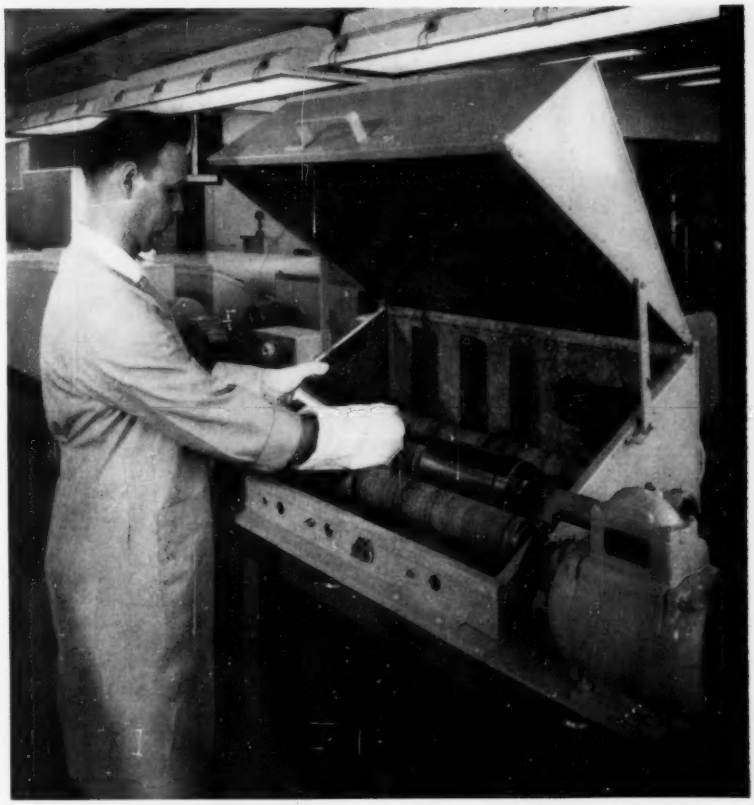
Oxidation Inhibitor for Lubricating Greases

According to Symon (U. S. Patent 2,910,437, assigned to Universal Oil Products Co.), the addition of 0.0001 to 5 per cent of 2,4'-diaminodiphenyl ether to lubricating greases retards oxidation of the product.

Process

Method of Preparing Lithium Base Greases Involving Quenching

Lubricating greases thickened with lithium soaps of hydroxy fatty acids can be prepared with relatively low soap percentages for a given penetration if crystallization of the soap takes place slowly while oil is being added. Preferred cooling of a molten homogeneous mass of soap and oil is controlled to



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Developing specialized greases for aviation, automotive, industrial, marine and high-velocity missile uses demands testing equipment that can evaluate greases for the unusual applications where precision, strength and reliability, over long periods of time, are primary factors. This heated roll test, which works the grease to determine its stability in bearings at high temperatures, is typical of the kind of research that is constantly being carried out in the new Research Laboratory at International Lubricant.

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a temperature at least 25°F below the solution temperature of the soap in the oil. This step is conducted at an average rate of at least 2°F but not below 25°F per minute by quenching with additional oil at a rate of 0.001 to 0.05 gallon per minute per pound of the soap-oil mixture. Supplementary cooling can be used to maintain the desired rate of temperature drop.

For example lithium soap was made from 12-hydroxy stearic acid, which soap was dispersed in a blend of oils having a viscosity of 475 SUS at 100°F and consisting of 15 per cent paraffinic oil with a viscosity of 90 at 210°F, 35 per cent naphthenic oil with a viscosity of 90 at 210° and 50 per cent of paraffinic oil with a viscosity of 185 at 100°F. Before cooling the mass contained 15.5 per cent of soap. The mixture was cooled from 400 to 350°F at the rate of 5.2°F per minute using 0.0035 gallons per minute of oil for each pound of soap-oil concentrate. Cooling of the mass from 350 to 200°F was at no predetermined rate.

The finished lubricating grease was smooth with an unworked penetration of 283 and a worked penetration of 269, according to Givens and Pitman in U. S. Patent 2,916,-452, assigned to Texaco, Inc.

Processing

Manufacture of Sodium Base Wheel Bearing Grease

The texture and other properties desirable in a wheel bearing lubricating grease are obtained, according to Nelson (U. S. Patent 2,916,-453, assigned to Texaco, Inc.), if a limited oxidation treatment is given to the saponifiable material and a portion of the mineral oil before the soap is formed. This saponifiable material should have an iodine number below 80 and be a mixture of glyceries with 40 to 80 per cent of fatty acids. The oxidation step consists of heating to 300 to 700°F in the presence of air until the viscosity has increased by about 5 to 35 seconds Saybolt at 210°F.

Thus, a mixture consisting of 80 per cent tallow fatty acids and 20 per cent tallow was added to an equal amount of a propane deasphalted residuum having a viscosity of 176.8 SUS at 210°F and the whole heated to and maintained at 480 to 495°F for eight hours with continuous stirring. Portions of the mixture were removed at two, five and six hours tested for viscosity increase and used to make experimental lots of lubricating greases. The respective viscosity increases were 12.0, 21.5, 30.1 and 46.7, the latter for the eight hour treatment.

Lubricating greases were made from the fractions by saponification at 250°F with a solution of sodium hydroxide. This was followed by dehydration at 300°F for two hours after which the mixture was cooled below 300°F and oil added to give a soap concentration of 17 per cent. Some of the characteristics of the finished greases are tabulated below indicating that too high a viscosity increase is not desirable.

Characteristics of Lubricating Greases

Saponifiable-Oil Blend Oxidized Hrs.	2	5	6.5	8
Dropping Point Lubricant	432	438	432	432
Penetration at 77°F				
Unworked	237	287	242	325
Worked	250	287	273	348
Grease Texture	Too fibrous	Excellent smooth short fiber		Buttery

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People in the Industry

Witzenburg Elected President of ASLE

The American Society of Lubrication Engineers has announced the election of L. O. Witzenburg, Cleveland Worm & Gear division, Eaton Manufacturing Co., Cleveland, Ohio, as president of the 3,000 member technical society. Prior to his election as president, Mr. Witzenburg served as vice-president at large and industrial director. He is also a vice-president of the Farval corporation, NLGI Associate member, where he is the Institute's Company Representative.

Dean M. Cleveland, Bendix Products Div., Bendix Aviation Corp., South Bend, Ind., was elected by the board of directors as vice-president at large. W. E. Hoch, Viscosity Oil Co., Chicago, Ill., was elected as treasurer, and A. E. Cichelli, Bethlehem Steel Corp., Bethlehem, Pa., was re-elected as secretary.

New directors elected for a period of three years are: S. R. Calish, Jr., California Research Corp., Richmond, Calif.; L. E. Hoyer, American Brake Shoe Co., Mahwah, N. J.; A. A. Raimondi, Westinghouse Research Laboratories, Pittsburgh, Pa.

D-A Names Isaacs Vice-President, Sales

Thomas W. Binford, president of D-A Lubricant company, Inc., recently announced the promotion of Charles R. Isaacs to the position of vice-president, sales of the Indianapolis, Ind., company.

Prior to his election to the vice-presidency, Isaacs was sales manager of the corporation, which manufactures a complete line of heavy-duty lubricants as well as specialized lubricants for high-performance automobiles.

A graduate of the Minnesota School of Mines at the University of Minnesota, Isaacs joined D-A in 1955 and had been sales manager since 1957.

F. J. Blume, Jr.

Funeral services were held April 29 for Frederick John Blume, Jr., a sales executive for Rheem Manufacturing company, New York, who died April 26 after an extended illness. He was 55.

Mr. Blume was born February 27, 1905 in New York City. He attended Dickinson high school, Jersey City, N. J. and was a 1927 mechanical engineering graduate of Stevens Institute of Technology, Hoboken, N. J.

After serving in sales and engineering positions for several companies, Mr. Blume joined Rheem in 1948 as sales promotion manager, Eastern region. After several promotions he became manager, national accounts, container sales, in 1952, the position he held at the time of his death.

Bonner Joins Dixon's Industrial Division

Joseph T. Bonner has joined the industrial division of the Joseph Dixon Crucible Co., Jersey City, N. J., as a lubrication engineer.

He will assist industrial salesmen in developing colloidal graphite accounts, field test new products and their applications, and supervise and

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develop technical bulletins and literature dealing with products manufactured by the company, which include industrial lubricants, paints and crucibles.

Bonner's former employers include the United States Rubber Co. and Tidewater Oil Co.

Vulcan President Named To Board of University Packaging Foundation

Vern I. McCarthy, Jr., president of Vulcan Containers Inc., Bellwood, Ill., has been named to the board of trustees of the School of Packaging Foundation at Michigan State university, Lansing, Mich.

J. Milton Moon, executive vice-president of Signode Steel Strapping Co., is chairman of the board of trustees of the Foundation. Dr. A. J. Panshin directs the Michigan State University School of Packaging, the only four-year accredited university level packaging course in the United States. The Foundation was created to meet the need for technically trained experts also trained for administrative work.

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- Increased film strength
- Increased lubricity
- Improved wetting of metal surfaces
- A strong bond between lubricant and metal surfaces
- Resistance to welding of metals at high temperatures
- Moisture resistance and inhibits corrosion

Harshaw Lead Bases are offered in three concentrations to suit your particular needs:

Liquid 30% Pb	Liquid 33% Pb	Solid 36% Pb

Other metallic soaps made to your specifications. Our Technical Staffs are available to help you adapt these products to your specific needs.

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American Potash Moves Zator to Los Angeles

American Potash & Chemical corporation has transferred Robert E. Zator from its Whittier, Calif., laboratory to the firm's Los Angeles office, according to J. L. Bills, manager of market research.

Zator, a former research chemist, joins the company's market research group as an analyst.

Atlantic Refining Appoints Chapman

The Atlantic Refining company has announced the appointment of Dr. Frank W. Chapman as manager of product development and technical services division of the firm's marketing department. He succeeds Dr. John C. Geniesse, who is retiring after 35 years' service with the company.

Dr. Chapman was employed by Atlantic as an associate chemist in 1950. Prior to his new appointment, he was director of the analytical section in the research and development department.

He is a member of the American Chemical Society and the American Petroleum Institute.

Harchem Names Antonovich General Purchasing Agent

Bruce S. Ainsworth, president of the Harchem Div., Wallace & Tiernan, Inc., has announced the promotion of M. F. Antonovich to the position of general purchasing agent for this division. This move consolidates all purchases of fats, oils and other chemical raw materials and supplies for the division.

Mr. Antonovich joined Wallace & Tiernan, Inc., in April, 1957 and became sales manager of the chemical department in January, 1958.

Previous to his connection with Harchem, Mr. Antonovich had been with Advance Solvents & Chemicals, Inc. for 27 years. There he served as import and traffic manager, export manager and eventually became vice-president and general manager of Advance's International Division. Concurrently he held positions with the parent company including sales promotion and advertising manager, sales manager of the Vinyl Stabilizer Division, vice-president and director of the Canadian affiliate.

Two Changes At Kerr-McGee

Kerr-McGee Oil Industries has announced that Mr. L. H. ("Sully") Sullivan, former manager of the lubricating oil sales department, is now general manager of the bulk sales department. Succeeding Sullivan is Mr. S. A. ("Si") Gunness, who will transfer from Chicago to Oklahoma City.

IOCA Selects Site For Annual Meeting

The Independent Oil Compounders association has announced the location of its thirteenth annual meeting . . . the Hotel Moraine on the Lake, Highland Park, Illinois.

A three-day session will be held Sunday, Monday and Tuesday, September 25, 26 and 27, 1960. Papers to be presented will be announced at a later date.

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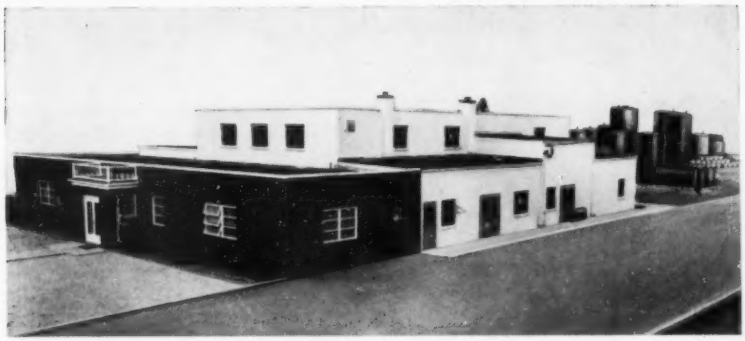
Industry News

Move to New Tank Farm by Bel-Ray



The manufacturing of special lubricants has actually reached the status of the compounding of other proprietaries (such as medicine) at the new tank farm of the Bel-Ray company put into operation at Collingwood Park, New Jersey, just three months ago.

This remarkable way of manufacturing lubricants to tight specifications is designed to service industries in which the nature of the product or the production machinery sets up unusual requirements for the lubricants used, according to William C. Kiefer, president of Bel-Ray. He cites the nontoxic, colorless "No Tox" lubricant supplied the food industry as an example of the former and the nongalling molylube "Anti-Seize" (extreme pressure lube) supplied to the mold and die shops as an example of the latter. Altogether Bel-Ray makes 250 lubricants and over 28 different types and variations of greases—each with a decidedly different formula for a decidedly different application. Included under the Bel-Ray brand are lubricants for low temperature applications that will not gum; lubricants for high temperatures that will not thin; lubricants for extreme pressures that will not corrode; lubricants to supply numerous varieties of dry coatings and lubricants that will not disintegrate in supersonic speeds.

In its move to Collingwood Park from its former plant in Madison, N. J., the Bel-Ray company has tripled its former facilities and gained a tank farm for the storage of over a score of components as well as 1500 feet of railroad siding. On the farm, metered tanks form a battery of gigantic beakers from which accurately measured amounts of the contents of any one tank can be automatically siphoned into a slurring tank for blending with the similarly measured contents from any of the other tanks to formulate a specified lubricant.

With such an arrangement the tightening down of specifications to an amazingly close degree is attained and the custom blending of lubricants to the user's own set of specifications becomes as simple and speedy as the blending of products that go out under the standard Bel-Ray label.

In addition to the facilities for compounding gained in Bel-Ray's move to Collingwood Park, N. J., the company also gained a more favorable location for deliveries. Halfway between New York and Philadelphia, the plant offers fast delivery service, to all the northeastern metropolitan area. Branches in Atlanta, Ga., Rochester, N. Y. and Pittsburgh, Pa., supply demands from other areas of the country.

Shipping in steel drums by motor truck or in carload lots, the Bel-Ray company sends out huge quantities of supplies for the motor industries as well as for industries that require the unusual, specialized lubricants. Henry Bedell, vice-president of sales, reports the com-

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pany expects to bring out a line of lubricants for marine use in the near future. This line is planned to overcome the shortcomings of presently available greases used for this purpose.

New Cartridge Gun

A fresh approach to grease packaging and dispensing has made itself felt in the national lubricants marketing picture during the past several years. From a quiet beginning, the 14½-ounce grease cartridge and companion cartridge loading grease gun have pushed their way into the forefront of modern merchandising methods.

As the grease cartridge has been developed, so has the dispensing gun, until now, a gun marketed under the name, "Econo Cartri-Loader" offers the user every ideal quality desired in a grease dispensing gun.

The new gun is a dual purpose (cartridge and bulk) loading piece of equipment which is precision engineered and manufactured with heavy gauge, plated steel throughout. It incorporates such features as (1) cartridge loading (2) bulk loading (3) adaptable to gun filling devices (4) improved gasket well in pressure head (5) improved rolled in threads (6) greater strength pressure spring (7) special bushing to protect against smashed fingers (8) positive locking device and (9) it will develop up to 10,000 pounds pressure.

The grease cartridge is undoubtedly one of the most spectacular aids that has been introduced into the lubricating grease field. Proper supply of quality components and a sound, aggressive marketing program will insure that you and not your competition will gain the maximum benefits already proven obtainable with this new marketing tool . . . and the forecasted volume of cartridge sales in 1960 has now reached 100 million.

For further information on this program contact: Battenfeld Grease & Oil Corp., Inc., 3148 Roanoke Road, Kansas City, Mo. ATTN: Lubricants Division.

Announces Full Commercial Status of Two New Grades Of Dimer Acid

Full commercial status of two new grades of dimer acid is announced by Emery Industries, Inc.

Empol 1024, which was designated Emery 3065-S during its development, is similar to the current standard commercial grade of dimer acid, Empol 1022. However, it contains less than 1 per cent monobasic acid (1022 has 2-5 per cent), making it more suitable for polymer uses.

Empol 1014, which supersedes Emery development products 3019-S and 3079-S, is a 95 per cent dimer acid also containing less than 1 per cent monobasic acid.

Present markets for dimer acid include rust inhibitors, surface coatings, urethane foams, polyamide and polyester resins, lubricating compounds, waterproofing agents, and surface active agents, among others.

1960 Chek-Chart Lubricant Recommendations Booklet

Publication of the 1960 Lubricant Recommendations booklet has been announced by the Chek-Chart corporation.

Packed with information that is essential to everyone engaged in a business where motor oil or gear lubricants are made, sold, or applied, it particularly serves as a source of vital reference for stationmen, tank truck salesmen, and oil company sales personnel and distributors.

To provide the very latest approved information and the most complete coverage, this handy pocket-size booklet contains complete motor oil and gear lubricant recommendations, plus crankcase, transmission, and differential capacities for passenger cars, trucks, and farm tractors. Also included are truck transmission and differential unit manufacturers' lubricant recommendations and capacities as well as similar coverage of special hydraulic and power units employed on farm tractors.

Complete information and prices on request.

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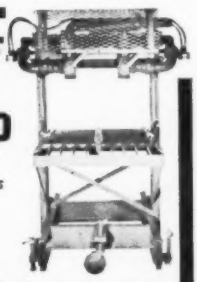

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THE CASE FOR LITHIUM: **IONIC SIZE**

Pauling's formulation of univalent crystal radii indicates that the lithium ion is indeed the smallest alkali metal ion.

ATOMIC AND IONIC RADII OF ALKALI METALS (PAULING)

	Li	Na	K	Rb	Cs
M (Angstroms)	1.225	1.572	2.025	2.16	2.35
M+(Angstroms)	0.60	0.95	1.330	1.48	1.69

Lithium's small ionic radius permits shorter internuclear distances between cation and anion. Thus, the lattice or crystal energies of lithium salts should be higher than those of other alkali metal salts. An analysis based on the Born-Haber cycle readily shows this to be true.

The heats of formation of large anion lithium compounds are usually lower than other alkali metal compounds due to lithium metal's high ionization potential and heat of sublimation. But this is not true for small anion lithium compounds. LiF, Li_2O, LiH, Li_2C_2, Li_2S, and Li_3N are all more stable than their other alkali metal congeners. And the freedom with which lithium combines with small anions may well be responsible for its excellent performance in metal scavenging and degassing.

IONIC POTENTIAL The concept of ionic potential (ionic charge/ionic radius) successfully relates the charge densities and deforming powers of the alkali metal ions. Lithium, of course, has the highest ionic potential of the alkali metals, and therefore, the highest free energy of hydration. And a modified Born-Haber cycle shows that lithium in aqueous systems matches cesium as the strongest reducing agent of the alkali metals.

SOLVATION ENERGY High ionic potential is also responsible for the unusual solubility behaviors of ionic lithium compounds. Lithium's high solvation energy favors breakdown of the ionic crystal lattice by solvent-ion interaction. Thus, the utility of LiH and $LiAlH_4$ as reducing agents. Unlike NaH and $NaAlH_4$, they are relatively soluble in diethyl ether, a desirable medium.

One indication of the extensive solvent-ion interaction suggested is the high hydration energy of the lithium ion . . . leading to an increase in lithium ion size in solution. The size increase is due to an adhering sheath of solvent molecules or dipoles. Thus, the lithium ion, smallest of the alkali metal ions in the solid state, is the largest in solution in water.

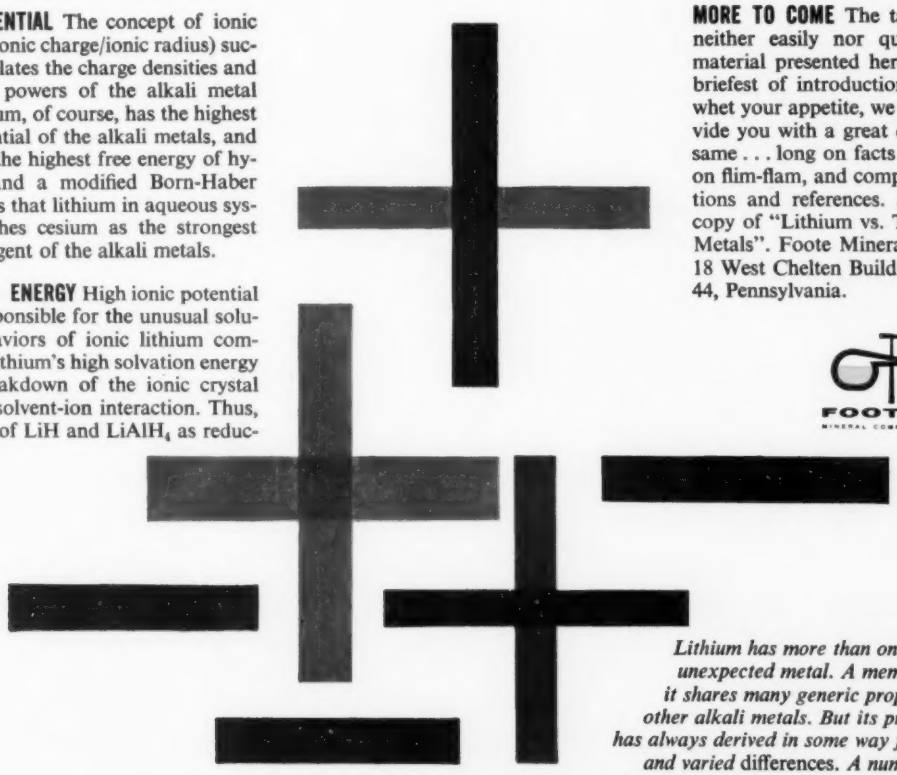
IONIZATION POTENTIAL AND RELATED PROPERTIES OF THE ALKALI METALS

	Li	Na	K	Rb	Cs
Ionization Potential (electron volts)	5.390	5.138	4.339	4.176	3.893
Oxidation Potential (E_o at 25°C, volts)	3.02	2.71	2.92	2.99	3.02
Heat of sublimation (kcal, 25°C)	36.44	25.95	21.52	20.50	18.83
Heat of Hydration of Gaseous Ion (kcal/mole)	123	97	77	70	63

The lithium ion—water dipole aggregates are probably responsible for the severely negative deviations from ideal solution behavior exhibited by lithium salts in solution. Lithium salts yield solutions with abnormally low colligative properties . . . very low aqueous vapor pressures, very low freezing points, etc. . . . as well as the highest stoichiometric activity coefficients of all the alkali metals. For equivalent molar concentrations of alkali metal salts, lithium salts have the highest effective thermodynamic concentrations, the basis for the superior performance of lithium bromide solutions in absorption refrigeration, and of lithium chloride solutions in humidity control equipment.

BOND CHEMISTRY With the highest electronegativity of the alkali metals, lithium has the greatest tendency to form covalent or mixed covalent bond types. Thus, lithium alkyls tend to be much more covalent than corresponding sodium alkyls, and as a result are far more soluble in non-polar solvents. But there is still sufficient polar or ionic character to the lithium-carbanion bond to exert an orienting force on such reactions as the stereospecific polymerization of isoprene.

MORE TO COME The tale of lithium is neither easily nor quickly told. The material presented here constitutes the briefest of introductions. But if it has whet your appetite, we can happily provide you with a great deal more of the same . . . long on facts and ideas, short on flim-flam, and complete with derivations and references. Just write for a copy of "Lithium vs. The Other Alkali Metals". Foote Mineral Company, 402 18 West Chelten Building, Philadelphia 44, Pennsylvania.



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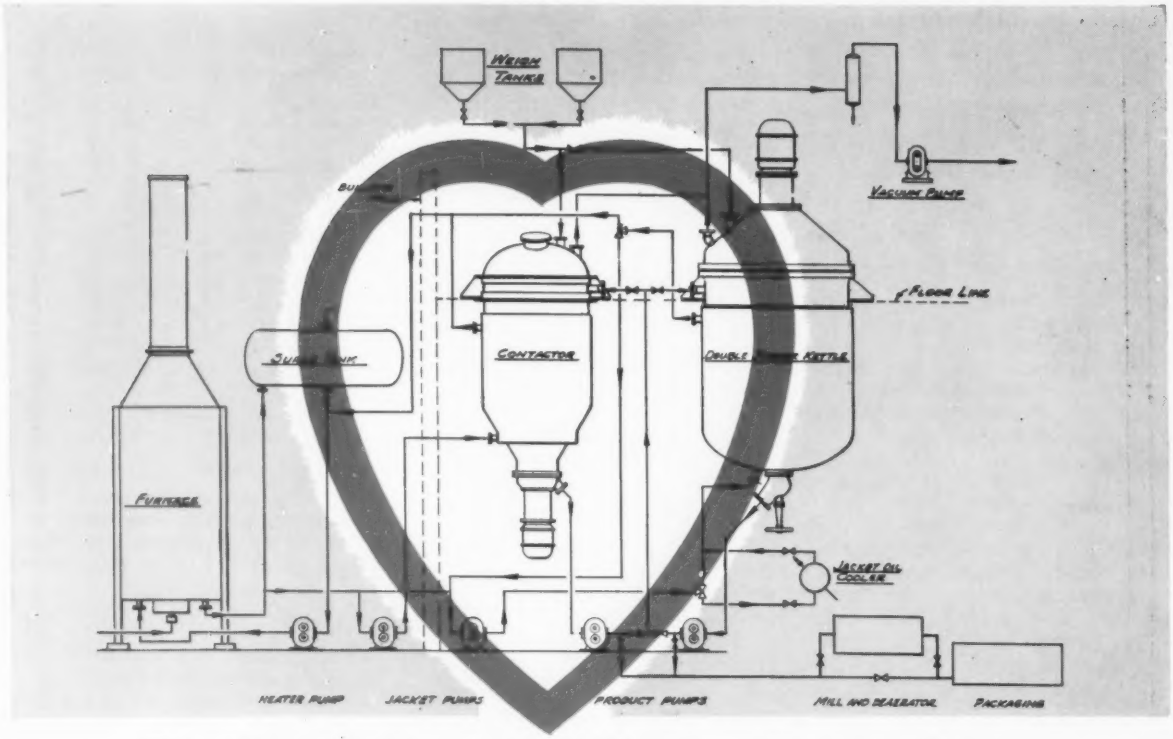
Lithium has more than once been called the unexpected metal. A member of Group IA, it shares many generic properties with the other alkali metals. But its primary usefulness has always derived in some way from its many and varied differences. *A number of the more interesting of these differences are discussed here, all of them related to the fact that, under varying circumstances, lithium has at once both the smallest and the largest of the alkali metal ions*



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